Ancient Textiles

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C. Gillis

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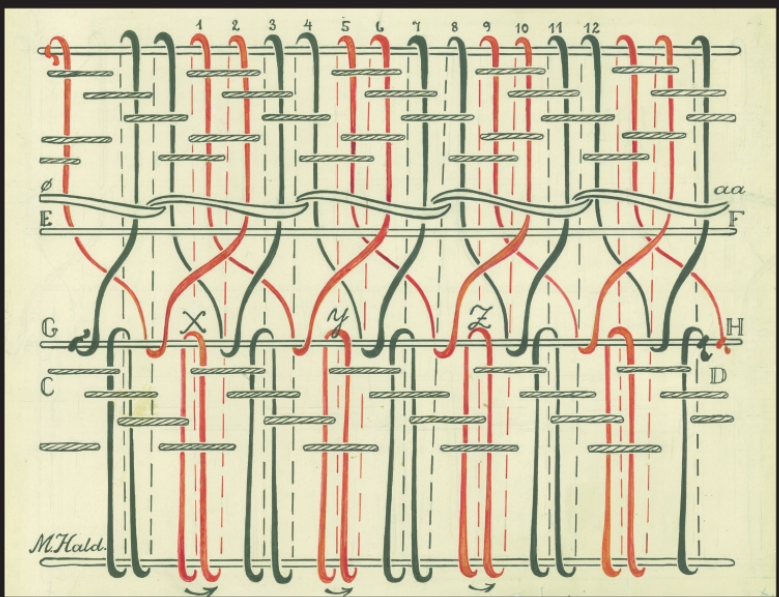
ANCIENT TEXTILES

Production, Craft and Society



edited by

Carole Gillis and Marie-Louise B. Nosch

Ancient Textiles

Production, Crafts and Society

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Introduction

by Carole Gillis and Marie-Louise B. Nosch

The Background

In past societies, textiles played a very important part in many spheres: social, economic, technological and aesthetic. An understanding of textiles and its role in older cultures is important not only for everyone interested in the past but also as a link in the chain from past to present. Textiles served–and still serve–various functions of a practical and symbolic nature. They have left quite diverse remains for modern researchers to find and attempt to weave together.

If one compares modern textile research in Southern Europe with that in Northern Europe, it is clear that there are two quite different traditions. In Southern Europe, the historical-philological tradition has had a major role as finds of ancient textiles are rare in the extreme but a wide range of written sources and well preserved contexts has permitted studies of the textile craft. These include its place in the various societies and the social position (or lack of) of the textile craftsmen and craftswomen. Pictorial sources such as vase painting and frescoes have provided evidence of fashion, production methods and tools, and art-historical considerations. Archaeological finds include finds like spindlewhorls and loom-weights

In Northern Europe, on the other hand, there is an abundance of preserved textiles, clothing, and related objects, but little written or iconographic evidence. Thus, the textiles themselves have been the focus of study, providing the basis for a large fund of knowledge about different textile techniques, materials and costume. Scientific analyses have also added to the fund of knowledge. Furthermore there is a 30-year tradition of experimental archaeology in textile

production.

The realization of the differences in approach and of the mutual benefits gained through the exchange of experience and knowledge led to a truly international and interdisciplinary collaboration between two prehistoric archaeologists, Eva Andersson (Lund University, Department of Archaeology and Ancient History, Sweden) and Ulla Mannering (University of Copenhagen, Department of Archaeology and Ethnology, Denmark), two classical archaeologists, Brendan Burke (University of Victoria, Department of Greek and Roman Studies, Canada) and Carole Gillis (Lund University, Department of Archaeology and Ancient History, Sweden), and one historian, Marie-Louise Nosch (University of Copenhagen, The Saxo Institute, Department of History, Denmark). Together they formed the research group *Ancient Textiles* in 2000, aimed at breaching the gaps. This collaboration led to a conference presentation and publication.[1]

Realizing how fruitful this first collaboration was, they wanted to continue such cooperation and dialogues on a larger scale. Dialogue is especially necessary in this area because very few textile specialists are trained exclusively in textile studies. On the contrary, most of us come to textile research via various disciplines: archaeology, history, epigraphy, conservation, art history, and ethnology. The cross-disciplinary exchange between all these traditions was a major issue. Second, the gap between the North European research, with its studies of textiles and tools, and the South European research, with its historical, pictorial and epigraphic approach, has been a clear problem in the field. Third, the conservators, the craftsmen, and the archaeologists all have different frames of reference. There is a definite need for these groups of people, all dealing with textiles but through their own disciplines, to create a common ground for discussion. Thus, the idea of an international conference was conceived.

The international conference *Ancient Textiles. Production, Crafts and Society* took place in Sweden and Denmark in March 2003. Generous funding was received from the European Science Foundation, the Elisabeth Munksgaards Foundation, Denmark, the Institute of Aegean Prehistory, USA, the Department of Archaeology and Ancient History, Lund University, Sweden, The Humanistic Research Council, Denmark, and The Swedish Research Council,

that enabled 52 textile specialists from 18 different countries to attend the conference.

The conference was the first of its type, and as a builder of bridges it was a great success. It enabled different categories of people involved in textiles to meet, talk and learn from each other, often for the first time. People studying textiles and their contexts experienced spinning and weaving first hand, while textile craftsmen learned more about the contexts of their craft in ancient societies.

The Publication

This conference volume contains a variety of individual and specialized areas, which reflects the current state of textile studies. But even more importantly, the volume synthesizes the larger issues and understandings which emerged during the course of the conference. Our combined expertise as textile researchers, scholars and craftsmen, with related interests from different disciplines and areas covering a wide range of time periods, geographical focal points, approaches and social structures, created and increased an understanding of textiles in a regional and global perspective.

In keeping with our interdisciplinary aims, the emphasis was not on specific geographical areas or fixed chronological frames. Instead, the articles in this volume are divided into four major thematic areas:

* *Methods and Background Studies*
* *Production and Organization*
* *Craft and Technology*
* *Society*

The volume starts with a triple introduction presenting the theoretical, historical, and practical frame of textiles studies. The three first authors, Wild, Bender Jørgensen and Ciszuk, combine the various aspects in textile studies as they all have practical and academic experience of excavations, textile technology, and application. In addition, all three understand and have worked with North and South European scientific traditions and methods.

In the second section, *Production and Organization*, the articles are presented in a somewhat chronological–although not geographical–

order. Despite the time span of more than four thousand years, from Ebla in present-day Syria at ca. 2400 BC to 17th-century AD Germany, major themes emerge in this section: the first and most evident is the similarities in the textile tools. Spindle-whorls and loom-weights are standardized implements in Mediterranean cities as well as in Viking Age settlements. This is seen especially in the papers by Andersson, Peyronel, Trinkl, Kirjavainen, Militello and Burke.

The second theme in this section is the complexity of textile production and organization, from workshop to industrial production, regardless of the place or period. This is evidenced through archaeological sources and discussed by Alberti, Burke, Militello, Gleba, Shamir, and through written evidence, as seen in the contributions by Rougemont, Tidow & Jordan-Fahrbach, Killen, and Hughes.

The third section is termed *Craft and Technology*. It concerns the product of the primary producer, the craftsman, and the actions and interpretations of the secondary receiver, the modern archaeologist or conservator. Again, we have two emerging themes, both concerning the application of techniques and specialization: the one deals with the concrete archaeological material, the other with scientific applications in the laboratory. The introductory article by Ræder Knudsen is a combination of both these aspects in which she takes up the ancient textile techniques as well as modern scientific methods for understanding them, as in the article by Mumford, Taylor & Prosser. Some articles are more concerned with aspects of production, such as that of Waetzoldt about the manufacture of strings, ropes, and related objects, and Möller-Wiering's, about sails. Trnka and Firth take up techniques in Aegean Bronze Age textiles, while Cortopassi, Tsourinaki, and Nikoleishvili & Akhvlediani all present technical analyses of tunics. Spantidaki & Moulherat's and Unruh's articles concentrate more on laboratory work on ancient textiles.

Textiles are important not only by themselves but also as fourth section, entitled *Society*, written by Barber. The symbolic significance of dress, patterns, and textile manufacture is discussed in the articles by Barber, Betancourt, Wincott Heckett, Anaya, Larsson Lovén, Good, Hedeager Krag and Cottica, all of whom place the symbolism and production of textile in a social and political

context. Tzachili looks at Bronze Age textile producers as members of a 'guild' and analyzes the socio-economic and political implications while Pautasso looks at female dress found in scenes painted onto the shoulder and chest parts of stone statues in Hellenistic times.

A common thread running throughout the volume is the communality and universality of textiles and textile production. Furthermore, links can be drawn between some articles: at the conference, many of the authors made good use of new contacts with others working in related areas, as can be seen in the articles here on sails in Mesopotamian written documents (Waetzoldt) and in Scandinavian Viking Age archaeology and iconography (Möller-Wiering). Möller-Wiering in turn also includes information on Aegean sails from the contribution by Burke.

A new approach to textiles and textile study was introduced at the *Ancient Textiles* conference: the interaction between academics and craftsmen. This theme is eloquently expressed by Ciszuk. The obvious importance of this connection is seen by the many references to his work and his article. Many craftspeople contributed their time and expertise at the conference, showing the scholars the practical side of textile craftsmanship: carding, spinning, setting up a loom, using different loom-weights and thread thicknesses in weaving, and much more. Martin Ciszuk, Anne Højrup Batzer, Lis Dokkedal, Lena Hammarlund, Anna Nørgaard, and Lise Ræder Knudsen gave generously of their knowledge and skills.

Another important contribution of this volume is the heightening of our awareness of the needs in this multi-faceted area. For example, archaeologists and excavation directors need to budget funding for conservation and storage of textiles. The differences between field conservation, museum conservation, and museum use are sometimes quite large. Advances in the areas of textile conservation, analysis and storage/exhibition provide new sources of information to archaeologists, historians, and other scholars, and have developed the whole area of textile research. In answer to an obvious need, some of the participants of the conference, conservators and fiber analysts, wrote a manual for dealing with textile finds in the field and afterwards (Jones *et al.*). This manual has been combined with an article on digital camera use (Bruselius

Scharff). It is included at the end of this volume as an appendix, but can also be acquired separately through Oxbow Books, and will hopefully become an integral part of all excavation equipment and all archaeological training.

This publication has received generous support from the Institute of Aegean Prehistory, USA, the Humanistic Research Council, Denmark, Queen Margrethe's and Prince Henrik's Foundation, Denmark. In addition there are many people who have helped in various ways: our thanks to Evelyn Kim and Carole Gillis for correcting the English, Ulla Mannering and Bengt Pettersson for the logo of the conference, the Saxo Institute, University of Copenhagen, for their support, Peder Dam for drawing most of the maps, Annette Borrell and Cherine Munkholt for assistance in many ways and Oxbow Books for all their help.

It is our hope that the Ancient Textiles conference and these proceedings have provided a foundation for all future research in the history of textiles. Through this monograph, we hope to have influenced the direction of future textile research by combining the specific methods and traditions of all disciplines involving textiles.

Carole Gillis & Marie-Louise B. Nosch, editors
Copenhagen and Lund, December 2005

Note

1 E. Andersson & M.-L. Nosch, "With a Little Help from my Friends : Investigation Mycenaean Textiles with the help from Scandinavian Experimental Archaeology", in *METRON. Measuring the Aegean Bronze Age. Proceedings of the 9th International Aegean Conference / 9e Rencontre égéenne internationale, Yale University, 18–21 April 2002, edited by Karen Polinger Foster and Robert Laffineur*, Aegaeum 24 (2003), 197–205 and table XLV.

PART 1 INTRODUCTION TO TEXTILES: BACKGROUND, STUDIES AND APPLICATION

1 Methodological Introduction

by John Peter Wild

The development of research into the history and archaeology of the earliest Old World textiles, the tools required for their production and the craftworkers themselves, is briefly reviewed as a preamble to a survey of the character of the primary evidence available to us, and current approaches to its interpretation. Surviving archaeological textiles and implements, their analysis by methods scientific and traditional, and the light cast by ethnographic studies are considered. Iconography and the multifarious written sources also make an important contribution. The risks inherent in combining information from multiple sources without due care and attention are emphasised.

For much of the world 2003 was the Year of the Sheep, just the right time to celebrate the growing band of scholars devoted to the study of ancient textile practices. It was not always so. Those of us with long memories will not forget the sense of academic isolation when there were so few colleagues with whom to share new discoveries and ideas. The field of study was international from the beginning, simply because scholars were geographically so scattered. Personal contacts and the regular exchange of off-prints were vital. Today, however, we can feel much greater confidence, though it is still an uphill struggle to feed our results into the wider world of archaeology, Ancient and Medieval history, lexicography and cognate disciplines.

My contribution has been entitled ‘Methodological Introduction’, but it is certainly not my intention to teach grandmother to suck eggs. Instead, I want to review briefly the spectrum of evidence on

which we can draw, highlighting on the way some of the special problems associated with it.

One of the principal dangers, as I see it, is an overly enthusiastic approach to combining evidence from two or more separate types of source in order to address a particular issue. I can only offer a personal view, and I apologise for that; but in quoting examples of difficulties and mistakes, it is more diplomatic to quote one's own errors.

First, a few words about the *Forschungs-geschichte* of ancient textile studies. It is not a new subject, and there were some giants in the past.

I would hesitate to claim that the collectors of holy relics in the Middle Ages were the first textile archaeologists; for the much-travelled scrap of Roman silk damask, now in the shrine of the Three Kings in Köln, was valued for its association with the physical remains of a saint rather than as a textile-technical accomplishment.[1] Ordinary people, however, made real textile discoveries. In 1850 peat diggers in Yorkshire uncovered a fully-clothed body, 'evidently a Roman ... the toga was of a green colour while some parts of the dress were of a scarlet hue; the stockings were of yellow cloth and the sandals were of a finely artistic shape.'[2] The body was reburied in a local churchyard, but the sandal and the shoe insole reached the Yorkshire Museum in York. Until recently the Roman attribution was dismissed;[3] but the finders now have the last laugh. The hobnailed sandal has been identified as Roman, 2nd or early 3rd century AD, and that must be true of the insole, too. One can only mourn the loss of the rest of the costume.

Serious academic study of early textiles in Europe tended to be finds-driven as archaeology emerged from antiquarianism in the 19th century. In Denmark, for instance, in 1861 speedy intervention by a founding-father of archaeology, J.J.A.Worsaae, led to the systematic excavation and recording of Bronze Age oak coffins in the mound of Trindhøj (*Ribe amt*) and the wool clothing they contained.[4] Peat digging in the Jutland peninsula brought to light some spectacular finds of wool garments ritually deposited in what were lakes of the Iron Age. A famous shirt from Thorsberg clearly fascinated the artist who painted it in 1861 for the National

Museum in Copenhagen.[5]

By contrast, in Egypt there was so much surviving textile material that familiarity almost bred contempt. The great cache of clothing from the 18th-dynasty tomb of Kha at Thebes,[6] however, was hard to ignore, as were the exotic garments from the tomb of T utankhamun.[7]

There were some valiant, contemporary attempts to assess these early textile finds, but it was some years before the true pioneers of textile archaeology emerged. It is notable how they were concerned, not just with analysis and recording, but with understanding their material in a wider context.

In the 19th century, sinking water-tables in the circumalpine lakes revealed the timbers of the *Pfahlbauten* (lake-side dwellings), and numerous scraps of cloth were recovered from them, now dated to between 4400 and 850 BC.[8] Many entered the collection of the *Schweizerisches Landesmuseum* in Zürich, where Emil Vogt published a ground-breaking account of them in 1937.[9] Fifteen years later, he turned his attention to the early medieval silks from reliquaries in the Valais, and his technical record of them has simply not been bettered.[10] In Denmark, Margrethe Hald's *corpora* of prehistoric clothing from northern bogs were illuminated by her fascination with the light that ethnographic parallels can throw upon finds and craft techniques.[11] Fascination with the living ethnographic tradition took Marta Hoffman in the fifties to Lappish Norway and to the rediscovery of how the warp-weighted loom was used.[12] For all three scholars, understanding the craftspeople behind the artefacts was a prime objective.

A few polymaths, like the industrial chemist Rodolpe Pfister, were as capable of tackling the technology of textiles, and in his case analysing dye-stuffs, as making sense of obscure ancient written sources.[13] Pfister's pioneering account of Graeco-Roman dyeing processes, written in 1935,[14] is almost as great an achievement as his reports on textiles from Roman Syria.[15]

The wealth of references to textile manufacture in the classical writers attracted the attention of James Yates, whose *Textrinum Antiquorum*, published in 1843, assembles the relevant passages and offers comment on them from an ethnographic and historical viewpoint.[16] His work was extensively quarried by later writers, not

least R.J. Forbes for his 1956 survey of textile production in the series *Studies in Ancient Technology*. Forbes' merit is to have brought together for the first time the archaeological and the written sources.[17] His colleagues in Leiden also plied him with information from ancient Mesopotamia and the Levant.

There are heroes–but also villains. The sad tale of how so-called Coptic textiles were recovered from late Roman and early medieval graves in Egypt does not need to be repeated. But at least they were recovered. Papyrus-hunters, by contrast, focussed on the rubbish dumps associated with the Roman settlements. Where papyri survive, so should rags. But they were presumably jettisoned, as well as a wonderful opportunity to match text with textile.

With rather more optimism we can now turn to questions of source critique. Every archaeologist working in a trench knows the feeling of slight irritation when a casual visitor asks, 'How did you know it was there?' The same question could be asked about the ancient textile industry. 'Archaeology' is an instant answer, but it needs to be qualified. Tools and textile fragments are archaeological artefacts, but so are sculptures and wall-paintings, Linear B and cuneiform tablets and papyri. Each, however, requires a different code to unlock the information which it contains.

Extant textiles are an obvious starting point, but accident of survival leads to a biased record. Peat bogs offer a classic textile-friendly micro-environment, but not for processed vegetable fibres,[18] and not if conditions are alkali, as they are at Illerup Ådal in Denmark.[19] Deserts, too, are selective. Cloth fragments survive well in the tower-tombs of Palmyra, but not below ground level in the city.[20] Frustratingly, when textiles survive, we can usually afterwards identify the particular contributing circumstances; it is much harder to predict in advance when and where textiles can be expected on an excavation.[21]

The importance of mineralised textiles is easy to overlook, but Lise Bender Jørgensen has demonstrated how an entire textile landscape can be created from such uninspiring finds.[22] Excavated sites with large, statistically meaningful groups of textile finds offer a stimulus to inter- and intra-site diachronic comparisons, but the familiar archaeological phenomena of rubbish-survival and residuality have to be expected. Jean Bingen has highlighted these

factors at the Roman mining complex of Mons Claudianus in Egypt, using dated documents to chart stratigraphic disturbances.[23]

It is easy to pin-point where inorganic artefacts like pottery were made: wasters stay on the site. Textile waste is negligible in amount. Instead, distribution maps are used to define production zones and centres–sometimes with misleading results. I am thinking of the once-supposed connection between the fine diamond twills at 10th century AD Birka in Sweden and the superficially similar twills of Palmyra 700 years earlier.[24] More plausibly, it has been claimed that the silks found in late Roman Egypt were woven there, but there is no confirmation of the theory in the mass of contemporary papyri.[25]

Textile implements, with a better survival rate than textiles, play an increasingly prominent role in the multivariate analysis of archaeological find assemblages, but their value depends on the correct identification of their function–something easier said than done. For example, long iron points appearing in sets in some migration-period and medieval European contexts have been variously interpreted as the teeth of wool combs or of flax hackles. Getting the answer right matters. It has been proposed as a rule of thumb that round-sectioned points are from wool combs, square-sectioned from flax hackles.[26]

A cautious glance at other types of evidence sometimes helps. A class of polished bone object, round in section and pointed at both ends, is often described as a 'pin beater'. Icelandic traditions show that the pin beater was used, not just to ease the weft into place but to keep warp in order. The weaver drew its point across the warp sheet as if across a stringed instrument.[27] The *kerkis* of Greek literature, a corresponding implement, is said to 'sing' in the weaver's hand.[28]

When is a loom-weight not a loom-weight? When it is large and crescentic, perhaps, as in Bronze Age Anatolia. Some reconstructions strain credulity, but the crescentic objects are found associated with conventional loomweights, and a satisfactory explanation is still sought.[29]

In recent times, the natural sciences have been a major source of new perspectives on ancient textile technology. Scientists, however, have a low boredom threshold, and the watchword is always

‘innovation’.

Arguably the most fruitful advances have been in the field of dyestuff analysis, thanks to the development and application of chromatography and visible-light and infra-red spectroscopy.[30]

Enlarging the data base continues apace, and there are still surprises enough to please the funding bodies. In biology, the more general availability of DNA testing promises new information on the evolution of animal and plant fibres, though the problems of obtaining viable samples from archaeological specimens are considerable. In electronic engineering, scanning electron microscopy has opened up another new world. Coupled with the application of standard industrial testing techniques it has begun *inter alia* to define and quantify wear on archaeological textiles.[31] Conventional archaeological methods of dating by association and context are normally adequate for textiles; but when the question of date is wide open, radiocarbon dating (a by-product of research in physics years ago) gives more precision.[32] The famous mitten from Aasle in Västergotland, for example, once dated to the 4th or 5th century AD, has now been assigned by radiocarbon dating to between 1510 and 1640 AD.[33] Obsession with the date of an object is becoming deeply unfashionable in some archaeological circles, but in textile studies, we are not yet so blasé.

Lines of enquiry all converge sooner or later on one determining factor, the craft skills and practices of ancient textile workers. But one cannot simply go and watch them at work–or can one? Somebody, somewhere in the world, may still be using the tools we recognise to achieve the product that we want to understand. The classic example of course is Marta Hoffmann’s record of the living tradition of weaving on the warp-weighted loom in western Norway, already mentioned. In a different context, Uygur weavers in northwest China sit in a loom pit against a wall, to weave a band with the aid of a treadle. The excavators of the 7th-century monastic complex of Epiphanius at Thebes in Egypt uncovered some strikingly similar brick-lined pits at the entrance to the monks’ cells, where the light was best. They were noted as possible loom pits at the time, but again, it is the living tradition that makes the interpretation plausible. These monastic loom pits may be the earliest indication for antiquity of a fixed loom with warp spanned horizontally.[34]

The concept of a horizontal loom in the West for weaving complex structures, damask and compound weaves, is a mirage which still lures us on.[35] The discovery, however, that late Roman silk tunics in compound twill could be woven in one piece on a loom of great size, as had been the norm for centuries, now puts a question mark over it.[36] Moreover, just that scale of loom for the production of complex patterned compound weaves has been recognised and recorded as a living, though declining, tradition in present-day Iran.[37] It is the *zilu* loom, and it is vertical.

So the mirage of the horizontal loom recedes yet again.

Where ethnography is silent, experimental archaeology takes over. It sets out to answer specific questions about early textile making, but, like the Kon-Tiki expedition, it can only illustrate what is feasible, not prove a thesis. Repeated experimentation can begin to reveal the requirements of a given task in terms of materials and labour. Research by experiment today covers a wide spectrum from the growing and processing of nettles to dyeing with muricid purples and of course, weaving.[38] The warp-weighted loom is being constantly revisited.[39] The results are of varying value, but serve to remind us that in antiquity, too, there were considerable local and regional differences in practice. To reconstruct the costume of the Viking aristocrat buried at Mammen, a team was assembled in 1988–9 to solve the technical difficulties of replicating each element of the ensemble as authentically as possible.[40] The late Hallstatt chieftain from Hochdorf enjoyed the same attention in 1995.[41] Experiment is a steep learning curve, and greatly enhances our appreciation of skills which were taken for granted in pre- and proto-history.

The images in ancient art of textile activities and paraphernalia almost always leave us frustrated. They reflect, and to us are obscured by, the conceptual conventions governing both the way in which the artist represented his vision and the way in which the beholder reacted to it. The result is not a photographic snapshot, more a shorthand essay. Early images of the loom help to make my point.

The Bronze Age rock art of the Val Camonica in North Italy shows many recognisable items of equipment from everyday life, especially agriculture. It has been plausibly argued that these are

warp-weighted looms, stripped to their essentials of frame, rods and warp-weights.[42] The famous weaving scene on the late Bronze Age urn from Sopron in Hungary also needs de-coding.[43] A favourite topic in Classical art was the encounter between Odysseus and the witch Circe when he finds her at her loom according to the Homeric account. On a late 5th century Boeotian cup in Oxford, our hero is evidently unhappy about his welcoming drink; but again, the essentials of the warp-weighted loom are present.[44] Some 600 years later, a Roman wall painter depicted the same scene, but, responding to the new technology, gave Circe the two-beam tapestry-weaving loom.[45] Finally, and somewhat incongruously, to illustrate Alexander the Great's visit to a silk weaver in India, a 12th-century manuscript illuminator presents us with the fully-fledged horizontal loom with which he himself was familiar.[46]

The examples which I have just quoted are all well known. But no two modern commentators see them in the same light. The interest lies in what the ancient artist does not tell us and what we are tempted to supply.

Finally I come to the source which is commonly consulted first–the written word. The formal literature of Antiquity, whether poetry or prose, seems, on the face of it, to be an accessible repository of knowledge. However, anyone who has struggled to make sense, for example, of the Elder Pliny's accounts of resist-dyeing or purple-dyeing may doubt that. He was a devoted observer of technology; but sometimes gives the impression of being unable to understand his own notes. The poets, too, had their own agenda. I will not pursue this further here: it is sufficient to say that the best information sometimes comes from between the lines.[47]

Ancient documents public and private offer an alternative perspective. They range from clay tablets in cuneiform script, to tablets in Linear B from Crete and mainland Greece in the late Bronze Age, letters on potsherds or papyrus from Graeco-Roman Egypt, the early 4th century AD Price Edict of Diocletian and the regulations of the medieval European weavers' guilds.

A significant problem impeding our exploitation of such sources is the impenetrable nature of much of the technical vocabulary. I can speak from personal experience only of Greek and Latin, but I think the difficulty is general–even in Chinese, if they would but

recognise it. To discover the meaning of a specific textile term, a lexicon is a good place to start, but a bad place to end.

Classical lexicographers tend to have recourse to the commentators of late Antiquity, if the term is a rare one, but the latter may know less than we do. There is the problem of semantic shift; for as technology develops, and particularly clothing fashions change, old words take on new layers of meaning.

Some years ago John Chadwick suggested in a college lecture that the epithet *pe-ko-to* applied to a specific type of textile in the Lc series of Linear B tablets from Knossos referred to 'sheared' or 'cropped' cloth, cognate with one sense of the Greek verb *péko* and the noun *pókos*, 'fleece'.[48] His remark made me think about the Latin *pexus,* a perfect participle of the verb *pecto*, 'comb', and an alternative sense of 'cropped' which can be read into it. That is apparent from a passage of Columella in which a Cappadocian lettuce leaf is described as *pexum*, 'furry'.[49] Roman wool shirts, described as *pexae,* had a nap that was raised and then cropped level. Indeed, it became such a common finish that *pexa* by itself became the ordinary word for a shirt in spoken Latin,[50] whether it had actually been soft-finished or not.

I have drifted already into the last topic I want to raise–the gains as well as the risks inherent in combining different types of evidence.

The phenomenon of spliced yarns in Dynastic Egyptian linen textiles was first noted by analysts many years ago, but brought into focus again recently by Hero Granger Taylor, Elizabeth Barber, and others.[51] Essentially, lengths of the fibre bundles found between bark and core of a flax stem were peeled from almost mature plants. These strands were overlapped by perhaps 5 cm, and the overlap given some twist to reinforce the adhesive power of the natural pectin in the fibres. Two such ready-spliced strands were then plied together for additional tensile strength.

The stages in this process are illustrated on a wall painting in the Theban tomb of Daga.[52] Kneeling women are splicing fibre lengths at the beginning of the sequence, and at the end, an extra twist is being inserted by a standing figure who draws the yarn from a bowl on the ground. A funerary weaving model shows such a bowl, with internal projections, and indeed in the archaeological record for

Egypt, the Near East and arguably prehistoric Europe, terracotta bowls with internal loops are found.[53] Confirmation came from the discovery of a living tradition of splicing nettle fibres in northern Japan, in which the spliced yarn is drawn under the loops of a very similar type of bowl which contains water to moisten the fibres. Archaeological, iconographic and ethnographic evidence all contribute, apparently seamlessly, to a coherent picture.

A classic example of the power of the sideways glance is John Killen's now famous paper explaining the terse flock records in Linear B at Knossos in terms of the sheep management strategies recorded in medieval English documentary sources.[54] The correspondence is uncannily close. Both landscapes were dominated by huge flocks of wethers, castrated males, in the care of individual shepherds. The aim was intensive wool growing: targets were set and shortfalls noted. English Heritage have recently announced a new Sheep Project to focus attention on the archaeological bone evidence for wether flocks in medieval England,[55] and the analytical methodology developed, might, one day, be applied to Bronze Age Cretan sites, too.

So, we are back to the theme with which I opened, the Year of the Sheep. May it be a good omen for textile studies in the year 2003 and all the following years.

Notes

1 Schrenk 2001, 117–118.

2 The account of the discovery of the bog body on Grewelthorpe Moor in Yorkshire comes from a 19th-century local newspaper. See Turner, Rhodes & Wild 1991.

3 Henshall 1950, 140 N. 1; Wild 1970, 42; 2003, 7; Turner, Rhodes & Wild 1991.

4 Boye 1894; Broholm & Hald 1935, 230–244; Glob 1974, 25–29; Munksgaard 1974, 59–69.

5 Engelhardt 1863; Munksgaard 1974, 137; Schlabow 1976, 69–71, Abb.135–138 (F.S. 3683).

6 Schiaparelli 1927, Figs. 62, 64; Vogelsang-Eastwood 1993, Pls. 3a, 3b.

7 Vogelsang-Eastwood 1999.

8 Messikommer 1913; Schlichtherle & Wahlster 1986, 12–21; Rast-Eicher 1997a.

9 Vogt 1937.

10 Vogt 1952; 1958; 1963; cf. Vogt 1934. His *Festschrift* (Degen, Drack & Wyss 1966) does not reflect his textile interests.

11 Broholm & Hald 1935; Hald 1950; 1962; 1964.

12 Hoffmann 1964.

13 Rassart-Debergh 1997, 57–58.

14 Pfister 1935.

15 Pfister 1934; 1937; 1940.

16 Yates 1843.

17 Forbes 1956.

18 Peacock 1996; 2001, 186–189.

19 Ilkjær 1990, 13–27.

20 Schmidt-Colinet, Stauffer & Al-As'ad 2000, 5–7.

21 Jakes & Sibley 1983; Sibley & Jakes 1984; Jakes & Sibley 1984; Turner & Scaife 1995; Peacock 2001, 184–189.

22 Bender Jørgensen 1986; 1992.

23 Bingen 1996.

24 Nockert 1988, 99–102.

25 Raschke 1975, 245.

26 Walton Rogers 1997, 1731.

27 Guðjónsson 1990, 173–174.

28 Wild 1967, 154–155.

29 Baykal-Seeher & Obladen-Kauder 1995, 237–245, Abb.164; scepticism from Vogelsang-Eastwood 1990.

30 Cardon 1990; Schweppe 1992; Wouters 1993; Cardon 2003.

31 Wild et al. 1998.

32 van Strydonck, van der Borg & De Jong 1993.

33 Nockert & Possnert 2002, 65–67.

34 Winlock & Crum 1926, 68–70, Fig. 25; cf. Hald 1964.

35 Wild 1987.

36 Flury-Lemberg & Illek 1995, 26–43, Abb. 41.

37 Vogelsang-Eastwood 1988; Thompson & Granger-Taylor 1995–6.

38 Fansa 1990; Peacock 2001; Cardon 2003, 425–432.

39 Batzer & Dokkedal 1992; Pfarr forthcoming.

40 Munksgaard 1991; Iversen 1991.

41 Banck-Burgess 1996; 1999; Ræder Knudsen 1999.

42 Zimmerman 1988.

43 Hoffman 1964, 317–318; von Kurzynski 1996, 44–46.

44 Vickers 1978, Pl. 62.

45 Wild 1970, Pl. XIb; 1992, 15, Fig. 5.

46 James 1902, 489, Scene 93; Cardon 1999, 601 Fig. 218.

47 Wild 2000.

48 Killen 1984, 50; Aura Jorro 1985, 98.

49 Wild 1967a; Columella, *de re rustica* II. 3. 26.

50 Wild 2002, 25–26.

51 Granger-Taylor 1998; Barber 1991, 44–50, 70–73; Cooke, El-Gamal & Brennan 1991.

52 Davies 1913, Pl. 37.

53 Barber 1991, 70–73; Busch 1995.

54 Killen 1964; 1984; cf. Halstead 2001.

55 Payne 2002.

2 The World According to Textiles

by Lise Bender Jørgensen

Textiles are a fundamental part of our material culture. They serve a wide range of purposes, functional and symbolic. Making them demands skill and raw materials, and is so time-consuming that advances in textile technology have had a major impact in economic and social changes. Textiles constitute a form of non-verbal communication. Using them takes different skills. This makes textile studies awash with fascinating questions and challenges. How do we deal with them? What questions do we ask, and what are our premises? This paper investigates the workings of textile archaeology.

Introduction

Textiles are a world of their own–and the world needs textiles. Surrounding us everywhere, they are a fundamental part of our material culture, serving a wide range of purposes both functional and symbolic. They provide us with cover against heat or cold, soft furnishings for our comfort, or shields for our privacy. Textiles are used in transport, as safety belts or in car tires, or in pre-industrial societies for animal trappings and blankets. Textiles are used for religious purposes, in art, medicine, and law. Business and engineering also deal with textiles, by making and marketing them. Textiles are important ingredients in social life. It is hard, indeed, to think of a field of life–or academia–in which textiles do not play a major role.

Making textiles demands raw materials, labor and skill. Production of raw materials such as wool, flax or cotton leaves marks on landscapes, dwellings and livelihoods. Textile manufacture is time-consuming–so much so that advances in textile

technology usually have had a major impact on society, leading to economic and social changes. The need for skilled manpower creates a social scene, forging and enacting relationships between the men and women involved in textile manufacture, and those who are not. *Using* textiles demands further skills, but different ones. What kind of fabric would be suitable for, say, a curtain? Selecting that is one such skill. It is quite another to use the curtain to decorate a room in the appropriate style, and to know whether, how, and when to draw it. Dress and dressing is also a subject of its own, combining function and meaning in innumerable ways–some obvious, others less so, and some very subtle indeed. It is a fully-fledged language, a form of communication without words.[1]

We all learn to speak our native tongue, and, perhaps, a few other languages. At school, we learn how our language is constructed, and how to use it to our best advantage. Mastery of language is promoted by understanding, by a large vocabulary, but most of all by a feeling for it–for rhythm and rhyme, and for the unwritten rules of eloquence. Dressing is learned in much the same way, often unconsciously, by picking up the rhythm and rhyme of clothing. Some get very adept at it, others less so. You can dress elegantly, casually, sloppily or wrongly–deliberately or unconsciously, and with or without flair. In each case, a message is transmitted, and usually clearly understood. Unlike spoken languages, dressing is rarely learned formally. It is not a subject taught at school, nor in the university. Still, the art of dressing correctly for the occasion is just as decisive for success as any academic skill.

These aspects make textiles and clothing –ancient as well as modern–a rich field of research, full of questions and challenges. Investigations tend to open fields of enquiry rather than close them, and although much work has been done, there is no sign that the subject has become exhausted. Still, the time feels ripe to take a closer look at the way we perceive ancient textiles and clothing, how we deal with them, what kinds of questions we ask, and what premises we work from.

The Construction of Knowledge

What kind of knowledge have we had of ancient textiles and clothing, and how have we acquired it? The 1920's and 1930's saw

a first golden age of textile archaeology. A range of pioneers started work, and published important studies.[2] Scandinavian scholars such as Hans Dedekam, Emilie von Walterstorff, Agnes Geijer, Margrethe Hald, and Björn Hougen; Emil Vogt in Switzerland; Georg Girke, Walter von Stokar, and Karl Schlabow in Germany all contributed to textile research in a number of works. In Britain, Grace Crowfoot worked on Ancient Egyptian textiles as well as Anglo-Saxon ones; in France, Rodolphe Pfister published a series of books on the textiles from Palmyra. In the USA, Lillian M. Wilson wrote her books on Roman textiles and clothing that remain standard works even today. This, indeed, goes for most of these scholars' works. It was a time of monographs: detailed descriptions and documentation, and focus on *what* kinds of textiles were found in archaeological excavations, *how* they were constructed, *how* they had been made, and *how* the more or less complete garments may have been cut and sewn. *How* the garments were worn, and *how* the people of the Bronze or Iron Age may have appeared, were also of interest, and were employed to offer glimpses of prehistoric life. Among other questions at issue were those of origins–*when* and *where* were textiles invented, what did they look like, which were the tools needed to make them, and how were the form, the decoration and the technology behind them developed? Questions like these–*what, how, when and where*–are characteristic for archaeological research in the 19th century and the first half of the 20th, the period when archaeology was established and gained its place in academia.[3] In many ways, the ideas behind it are those of the Age of Enlightenment: we seek knowledge of the world, as an alternative to that presented by the Christian church, according to which everything was created by God in the year 4004 BC.[4] The first step towards such knowledge is description: how is the world constructed, what soils, minerals, plants, animals, etc., does it contain, and what rules (other than the will of God) determine what exists and how it exists. This is what the pioneers of textile archaeology have presented us with: identifications of fibers, yarns and weaves, dyes and colors, techniques and designs, and forms of garments, all sorted into various categories, like in a great chest of drawers. It is an alphabet and–perhaps–a glossary that help us towards reading ancient textiles. But even so, they represent only a first step towards understanding the language–perhaps hardly more than the phrase books that tourists use when first visiting a new

country. How detailed is this dictionary of ours? What about grammar, shades of meaning, and etymology? What questions can we ask to gain deeper knowledge, and better understanding?

Experimental Archaeology

A way of answering some of these questions is through experimental archaeology. Many pioneers of textile archaeology were craftspeople rather than archaeologists, invited in to tackle aspects that excavators felt themselves unable to deal with. Some had been raised, or spent part of their life, in societies that still employed pre-industrial textile technology, and used insights gained from their experiences to understand ancient textiles.[5] This has had many advantages, but also disadvantages. For someone who *knows* how to spin on a hand-spindle, or weave on a warp-weighted loom, certain aspects of these crafts are so obvious that they are taken for granted. When that knowledge dies out, and replication is attempted, those aspects are far from self-evident. The present generation frequently comes across such features when doing experimental archaeology. Sometimes, when recreated practices come face to face with people carrying on a living tradition, clashes appear, revealing gaps in our knowledge, but also gaps in understanding of how knowledge is constructed and perceived.[6]

Inductive and Deductive Reasoning

Early textile studies, and many current ones, employ mainly an empirical, *inductive* form of reasoning, based on the collection of data. The starting point is a mass of data–in our case remains of ancient textiles. How to make sense out of them? Behind the sorting into categories and search for origins lies the assumption that the textiles reflect a truth about the past, and that the scholar's task is to reveal this truth. Identifying and labeling them is one of our means in obtaining this goal. At a Scandinavian conference of scientists in 1898, Swedish archaeologist Oscar Montelius described his newly invented method of 'typology' as such, 'We gather as many artifacts as possible and arrange them in a way so that the result immediately leaps to the eye.'[7] Accordingly, the hallmark of an able researcher is the ability to do just that. An important aspect is that the scholar's authority plays a part in this.[8] With truth as the

goal, only correct solutions can be considered as acceptable scholarship. This means that if someone is able to find flaws, reputations are at stake. This attitude is found in many works of scholarship, pin-pointing other people's mistakes and meticulously correcting one's own.[9] Further, as *description* is an essential part of scholarship, it becomes important to monopolize access to the data that are to be described, to prevent other people from stealing one's thunder.

Experimental archaeology, on the other hand, is based on *deductive* reasoning. Research starts with a question, a hypothesis. Take, for example, Andrew Sherratt's suggestion that the occurrence of wool was part of what he termed the 'Secondary Products Revolution', a second phase of the process of Neolithiza-tion. [10] At the time of proposing this, Sherratt had little evidence–the stronger parts of his reasoning were based on other aspects of the 'Secondary Products Revolution'–and in the following years he kept looking for empirical data that could support or disprove his hypothesis.[11] Scholars tend to accept Sherratt's theory; to take it as gospel is, however, a great misunderstanding.

The two forms of reasoning–induction and deduction–tend to clash: they simply start from opposite ends of the ladder. When both parties are aware of this, collision is easily avoided. Often, however, that is not the case. In many universities, archaeology is still taught by tacit transmission of knowledge, like craftsmanship, with little or no emphasis on the philosophy of science.[12] The last thirty years have seen a continuing battle between 'theoretical' archaeologists and 'traditional' archaeologists, both parties vilifying the other.[13] The former could express themselves more clearly, but the latter could certainly take more pains to understand. A clear grasp of–for example–the difference between inductive and deductive reasoning would facilitate discussion, and help avoid misunderstandings.

Is deductive reasoning better that inductive reasoning? In both cases, there is a tendency to look for the 'truth', a perfect and objective image of the past, including the textiles and clothing of that past. Since the 1980's, postmodernists have put this ideal on the block. Part of the battle between theoretical and more or less traditional archaeologists is about whether the *past* (a single universal past) exists –or existed.[14] The post-modernist attitude is

that it did not, and that the only aim for research is to present attempts at interpreting certain situations in the past–as stories or narratives–based on the firm conviction that no single version of those situations would ever be correct: it always remains a point of view, or the suggestion of one. How, for example, can we interpret the edict, issued by Emperor Honorius, forbidding the wearing of trousers in Rome?[15] That no decent Roman citizen would ever dream of wearing trousers? Or the opposite, that too many people had taken to this repulsive habit? Or did it mean something else, tacitly understood at that time, such as, perhaps, the discouragement of military garb in the City? According to post-modern –or post-processual–thinking, all of these interpretations could be equally valid, even simultaneously, depending on the eyes of the beholder. The focus of interest has changed from what, how and when to *why*.

Post-modern thinking is bringing inductive reasoning back into favor. Combined with deductive reasoning, and statements about which assumptions and arguments the proposed view is based on, inductive reasoning is quite acceptable.[16] The description and ordering of data are no longer the hallmark of good scholarship. Neither is the proposing of theories to be proved or disproved at some later stage. Instead, its quality is measured by how the case in question is presented, how the premises are made clear, and how well it is argued.

Textile Archaeology and Theory

In many ways, textile archaeology is still based on empirical studies and inductive ways of reasoning. This certainly applies to my own work on the textiles of northern Europe, defining textile types and charting them chronologically and geographically.[17] My goal then was to provide a general structure, a sky against which the stars of famous finds could shine, like the Danish Bronze Age costumes, the Birka textiles, or those from Sutton Hoo.[18] The problem with this way of working is that it often turns stale. After a while, a general pattern can be established that rarely changes, no matter how much data you add. This is when a change is helpful; and that is generally why archaeology has changed its theoretical perspectives several times. When patterns start repeating themselves, students and (young) scholars become bored and want to do things differently.

How can we employ post-modernist theory to archaeological textiles? In my opinion, very well indeed. The idea of multiple readings and of acceptance of the scholar's individuality, preconditioning background and assumptions –in other words subjectivity–is ideally suited to deal with features as laden with meaning as textiles and clothing. Textiles normally serve several purposes at the same time. As clothing, they keep us warm and comfortable and protect us, while at the same time proclaim who we are, or want to appear to be; this latter is true also for flags and banners, which signify identity, wealth and pride, *and* serve a practical purpose as rallying points in chaotic situations such as military action.

Mons Claudianus

Let us take a look at a concrete example. When dealing with the textiles from the Roman quarry at Mons Claudianus in Egypt, both empiricist and post-modernist thinking are helpful in clarifying what we do with the textiles, how we do it, and why we do it.[19] Our starting point was huge quantities of textiles, excavated from the quarry's rubbish dumps, and dated within approximately 50 years in the reigns of Emperors Trajan, Hadrian and Antoninus Pius. What to do with them?

We started in a mode of inductive empiricism, describing each textile fragment meticulously: size, shape, fiber, spin, weave and color, traces of use or repairs, decoration, etc., along with details of provenience, layer, and the recording date. This went on for a while, enabling us to make statistic work-ups on the variety of fibers, or the frequency of tabby or twills. After several weeks of hard work, we realized that we had made only a small dent in the lot, and that it would take several years and a host of textile archaeologists to catalogue them all–and we would hardly be much wiser than we already were. As a result, we changed our strategy to a deductive mode, established a representative selection by sampling textiles from the main areas, and started searching for unusual pieces to illuminate the totality.

A further stage came later, when, back in Europe, we tried to make sense of all our records. How could we make them tell a story that went further than what statistics and comparisons could offer?

To do this, we proceeded into a contextual mode, greatly assisted by textual evidence. Nine thousand *ostraca*[20] inform us of life on the site, and many details of its inhabitants.[21] Lists of water rations, for example, reveal that on a certain day during Trajan's reign, the population consisted of 421 Egyptian stone masons or *pagani*, 60 soldiers, 32 people engaged in service trades, and 400 members of the Imperial *familia*, the latter a mixture of slaves, freed-men and free-borns. Wage lists and other documents inform us that the *pagani* stone masons were well paid, and received far better rations than the members of the *familia*. Still, none of these could compete with the soldiers, who had access to a variety of delicacies, including piglets and fresh vegetables.[22] How can we apply this information to the textiles? If we assume that differences in pay and food between *pagani, familia* and soldiers also included textiles and clothing, we may employ deductive reasoning to look for evidence linking distinctive features to certain groups. Could *clavi*–the pair of vertical stripes adorning many Roman tunics –be a prerogative of soldiers? The number of *clavi* found at our site speaks against it.[23] This is further supported by evidence of clavate tunics on mummy portraits from the same period that show that most males wore them.[24] Could the *clavi* then be the sign of a free man? Hardly, as domestic servants are depicted in Roman wall paintings wearing clavate tunics.[25] Still, the remains of a much-repaired tunic from Mons Claudianus reveal special efforts to retain the *clavi* despite all changes, while other tunic remains appear to be *without them.*[26] That suggests that the *clavi* held a special meaning, and were worth coveting.

What makes this way of reasoning better than good old-fashioned empiricism? The increased awareness of assumptions, premises and forms of argument reveals the craftsmanship in scholarship. Displaying the raw materials and tools of research demonstrates how knowledge is created.[27] It also makes it easier to relate to fellow scholars: as friends and colleagues, rather than competitors. When knowledge is perceived as created rather than revealed, and the subjectivity of individual scholars as inevitable, monopolizing data and sources becomes meaningless.

The World According to Textiles

The world today is different from what it was at the beginnings of

archaeology, posing different questions. A multicultural world seeks identities, locally as well as through greater political entities like the European Union, to create a feeling of 'we' in contrast to 'other'.[28] Archaeology–and perhaps particularly that of textiles and clothing–holds a great potential for legitimizing the rights of various groups by telling stories of their glorious past. Consequently it is much sought after–never has so much money been spent on studies of the past. The craving for adventure is another feature of the modern world that causes a demand for knowledge of the past. Role plays and reenactment societies are immensely popular; many people spend a lot of their time recreating the Middle Ages, dressing up like Vikings, or doing Roman military drills. The past has turned into a foreign country, and attending a Medieval fair is as much fun as traveling. How do we deal with this? Should we frown on such inappropriate ways of using our hard labor, our dearly acquired knowledge?

We have seen how earlier scholarship set out to describe the world, by meticulously recording all conceivable details, and engaging in a quest for origins. We have also seen how this applied to the pioneers of textile archaeology. Today, the quest for origins has become tinged with Eurocentrism, and is becoming increasingly politically incorrect. Does that mean that we should stop and avoid looking for the beginnings of textile technology? I think not, and neither do I feel that we should stop reconstructing ancient clothing to prevent it being used to forward issues of identity. It is, however, important to address political aspects of archaeology, including that of textiles, so that we embark on our research with open eyes. Do we need more details of our ancient textiles, of sheen and luster, tex and cover factor, and other aspects that may be documented by science, or would we rather try on a Roman toga, to experience how it feels, how it drapes, and how it is to move around in, imagining ourselves to be Cicero, driving home a point in a legal argument? Is experimental archaeology a fruitful way to investigate the intricacies of textile technology, or to chart how craftspeople think in action? Multiple approaches hold multiple promises. I think we are going to see many examples of fruitful ways to employ textiles, textile tools, and other forms of evidence to create new images of the past.

Textiles in Academia

Where do textiles come into academia? Departments of Textiles do exist, usually included in Departments of Art History, Education, Home Economics, or Engineering. Textiles are relevant for a wide range of academic subjects, and a growing interest shows that people are beginning to realize this. We may soon see Departments of Textiles in their own right among the Humanities and Social Sciences. Perhaps some day textiles might even become a faculty of its own, with high status bestowed accordingly upon textile scholars. Pipe dreams perhaps–but academia does not reflect an absolute constitution of well-defined knowledge. It changes over time. As an example, theology is the oldest discipline in Western universities, until recently organized at the faculty level. Today, this is no longer automatically so. Increasingly, theology is becoming incorporated into the humanities, often re-named as religious studies. Law is another classic field in the process of losing its traditional status, while new fields, such as engineering, business and education are being promoted.[29] Why not textiles? Then we will really be able to explain the world according to textiles.

Notes

1 See, e.g., Barnes & Eicher 1992; Eicher 1995; Rubinstein 1995; De la Haye & Wilson 1999; Crane 2000; Entwistle & Wilson 2001.

2 Dedekam 1918; 1920; 1925; 1926; von Post et al. 1925; Broholm & Hald 1935; 1939; 1940; Hougen 1935; Geijer 1938; Vogt 1937; Girke 1922; von Stokar 1939; Schlabow 1937; Crowfoot 1931; Pfister 1932; 1934; 1937; 1938; 1940; Wilson 1924; 1938.

3 The following has grown out of seven years of teaching archaeological theory to undergraduate students at the Norwegian University of Science and Technology, Trondheim. For more details, see, e.g., Trigger 1989; Schnapp 1996; Olsen 1997; Preucel & Hodder 1996; Johnson 1999; Renfrew & Bahn 2001.

4 The scholarship of Archbishop James Ussher in the 1650's established this dating of Genesis, see *Britannica Micropaedia.*

5 Margrethe Hald is an example of this. Born 1897 on a farm in Jutland, Denmark, she was educated as a weaver (*Dansk Biografisk*

Leksikon). Grace M. Crowfoot is another good example. The wife of a civil servant in the British administration of Egypt and the Sudan, she became interested in traditional weaving techniques by observing local women and taught herself to use primitive looms, Ferry 1998, 15, 22f.

6 See Martin Ciszuk's paper in this volume.

7 Montelius 1900, 268; 1903, 17, quoted by Gräslund 1974, 210, and Olsen 1997, 80. Montelius mentions clothing as a particularly promising field for typological studies, Montelius 1900, 260.

8 Olsen 1997, 85–86; Åberg 1929, 512f.

9 Vol. XXV (1954) of the *Acta Archaeologica* (Copenhagen) contains a series of papers by Scandinavian scholars such as C.-A. Moberg, C.J. Becker, E. Kivikoski, O. Voss and E. Dyggve, all reflecting this attitude.

10 Sherratt 1981; 1983.

11 Sherratt 1997, 203–205.

12 See, e.g., Biehl, Gramsch & Marciniak (eds.) 2002. See also Polanyi 1958 [1998, 53] for views on how the unspecifiable *art* of scientific research is transmitted.

13 Dark 1995; Johnson 1999; see also Olsen 1997, 59ff.

14 Shanks & Tilley 1987, 243ff; Olsen 1997; Johnson 1999. Much of this thinking is inspired by Paul Feyerabend's anarchistic view of scientific method, Feyerabend 1978.

15 Munksgaard 1974, 116; Wild 1968, 181, 183, 277; Bender Jørgensen 1986, 154/351; Harlow 2004. My thanks to Mary Harlow for letting me see her pre-publication text.

16 See, e.g., Marcia-Ann Dobres's engendered *châine opératoire* (2000, 208).

17 Bender Jørgensen 1986; 1992.

18 Bender Jørgensen 1986, 9/285.

19 Bender Jørgensen & Mannering 2001.

20 Pot sherds with writing.

21 Bingen et al. 1992; 1997; Bülow-Jacobsen 1996; Cuvigny 2000.

22 Van der Veen 1996; Maxfield & Peacock 2001.

23 Mannering 2000, 285; Bender Jørgensen 2006.

24 Doxiadis 1995; Corcoran 1995; Walker & Bierbrauer 1997.

25 The Paul Getty Museum, Malibu, California No. 79 AG 112, dated AD 50–75.

26 Mannering 2000.

27 For a description of how scientific joints are made, see Latour 1999.

28 Ucko 1995; Graves-Brown et al. (eds.) 1996; Diaz-Andreu & Champion 1995; Rathje 2000.

29 For examples, see the websites of various universities such as www.gu.se, www.ku.dk, www.hu-berlin.de, www.ox.ac.uk, www.stanford.edu.

3 The Academic Craftsman–A Discussion on Knowledge of Craft in Textile Research

by Martin Ciszuk

In modern archaeological textile studies there is a need to deepen the discussion about the use of craftsmanship as a method in research. This paper is based on the double competence of the author: having a MA degree in textile history and being a trained and professional craftsman–a hand weaver. The discussion uses examples from the Mons Claudianus textile project. This project is a study of textiles found in a Roman stone quarry in Egypt, led by Lise Bender Jørgensen, where Scandinavian craftspeople and archaeologists have cooperated.[1] *The question about academic craftsmanship is linked to a discussion among philosophers of knowledge like Michael Polanyi, Gilbert Ryle, and Bengt Molander, where notions like 'knowledge in action', 'tacit knowledge' and the 'difference between knowing how and knowing that' are used.*[2] *To enlighten the craftsman's role in research, some methodological tools are used, taken from the French sociologist Pierre Bourdieu.*[3]

In post-modern research, focus is placed on the importance of reflecting over the personal role of the researcher. In earlier textile research there was a very limited discussion of the researchers' role, paradigm and methodology. What we today classify as diffusionism and typology was once considered as the natural way to treat a body of material scientifically. With increased consciousness of the relativity of methods and theories, a declaration of the researcher's

personal role and the methodological choices made have become more important. The academic researcher cannot any longer see himself as a neutral tool; rather, he is as an active part, participating in the creation of his data and methods.

The field of textile research could be described as a field dominated by academics: archaeologists, ethnologists, art historians, etc. To these is given the mandate to decide about what and how research should be done. In an ancillary role are the textile engineers, who use methods from science, industry and mathematics to provide the academics with hard facts such as measurements and numbers. The craftsmen have been in a subordinate position, but are now breaking in. They have always been acknowledged by the academics, and sometimes their terminology is used, but craftsmen are seldom given the leeway to develop their own methods of analysis, or present the results of their studies as scholarship. Their task is often reduced to illustrating the results of the academic research, or to carrying out experiments investigating academic questions.

The knowledge of craft and academic knowledge are two very different things. The knowledge of a craft is mostly tacit knowledge, linked to action and embedded in body and hands rather than in mind and reasoning. This makes craftsmen's knowledge hard to describe and consequently hard to refer to in an academic context. These features are the main reasons for academic scepticism and resistance to participation of craftsmen in textile research. The nature of craftsmanship as tacit knowledge and knowledge in action is a complication also for the craftsman doing research, when taking a critical position concerning his own methods. Knowledge in action is firmly embedded in the personal culture of craftsmanship of the practitioner. Craftsmen tend to explain their choices as methods developed by tradition and experience, and say that their actions are the most fitted and natural for their task. Drawing on this there is an evident risk for the researching craftsman to fall victim to positivistic reasoning–'If I can do it this way –it was made this way' or 'This is the natural way to do this'. The craftsman's rational explanations for his methods are often a chimera, a fairytale of explanation–even if the results are satisfactory.

On a study trip to Morocco in November 2001 by the Mons Claudianus Textile Project, the Swedish hand weaver and spinner

Lena Hammarlund met a woman spinning thin yarn from combed wool. When Hammarlund tried the spindle and spun in s-direction, as is most common in the Mons Claudianus textiles, the Moroccan woman corrected her, saying, 'That is wrong, you should not spin this way.' It was obvious that the direction of twist was important, and handspun yarns in Morocco follow a tradition of z-spinning. However, Hammarlund's experiments show clearly that the twist direction in most cases is of minor importance for the appearance and properties of the finished yarn or cloth.[4] The direction of twist is thus of cultural rather than functional importance. Researchers with a functionalistic or utilitarian perspective do not accept this, and textile literature gives numerous explanations for differences in twist direction: the position of the spindle whorl on the top or the bottom of the spindle, different methods of starting the spindle's rotation, different working positions, differences in raw material, or properties for felting, etc. There is often a reference to craftsmen, but without a reflection over the context and what part is cultural and what is functional.

Lise Bender Jørgensen's extensive study on the prehistoric textiles from Scandinavia and northern Europe was made from a classic archaeological perspective.[5] The textiles are considered as signs, and used to interpret the development of the prehistoric societies. Reduced to weave, thread count, and direction of twist, the textile data made it possible to make geographical and chronological analyses and conclusions. However, when craftsmen tried to use this publication to reconstruct archaeological textiles, it became clear that these data were not sufficient to describe the look, properties or function of the textiles. In the textiles from Mons Claudianus, this became even more evident. It was possible to determine different types of cloth with the naked eye, but the data of weave, direction of twist and thread count could not define these types. From this starting point Lena Hammarlund made an important study.[6] While looking at the fragment from her perspective as a spinner and hand weaver, she grouped the textiles according to their visual properties. Then she made a system of definitions to distinguish these groups from each other. To describe the properties of the textiles, and thereby define the groups, it was necessary to add factors such as yarn diameter, hardness of twist and fiber types. In an extended study the twill fragments were included. This resulted in a hypothesis about different textile

‘families’–textiles showing common traces of the craftsmen’s choices, and probably representing different traditions of craft. In the ‘families’ there are common characteristics who are only recognized through this profound analysis: these also unite different types of weave. These families could also be divided into subgroups which might reflect cultural and/or geographic differences in the textile production. Hammarlund’s craftsmanship was a precondition of this study and much of her reasoning was based on experimental weaving.

The author’s part of the Mons Claudianus textile project has been to study the technically complicated bindings, taqueteé and damask, and to discuss the Roman loom used for patterned textiles. The choice of these textiles was founded on an interest for technical solutions for patterning and the use of technically advanced looms in the author’s education and profession. Analyses and discussions have been accompanied by experiments and reconstructions–on modern looms, on weaving frames, and on a reconstructed Roman vertical loom. The results from these experiments show that it is possible to produce these advanced techniques on a vertical loom–but they do not by themselves prove that they were done exactly in this way in Roman Egypt. On the mentioned journey in Morocco, the participants saw women weaving on the vertical loom. This drew attention to how the author in his experiments unconsciously used manipulations and solutions borrowed from modern hand weaving. In comparison to the Moroccan culture of craft these seemed very awkward: the use of a shuttle to insert the weft in the weave, the knotting of heddles from right to left, a great concern about good light and comfortable working position, and a sturdy loom with right angles in every detail, etc. The Moroccan craftwomen had made other solutions suitable to their culture of craft–a system of actions and thoughts that included both their material and their immaterial culture. The value of practical experiments lies in the knowledge acquired of the techniques and technical details that are essential for analysis and interpretation of archaeological textiles. This technical understanding is impossible to gain without physically weaving the techniques, but it is limited by the researching craftsman’s culture of craft, imprinted by his education and profession. Working methods and organization of work are governed by the craftsman’s social situation and his perception and assessment of the work–and these are relative

values. The notion of how and why you should work is discursive, which means that it will vary in different fields of society and in different periods. The craftsman doing research has to reflect on his own perception of craftsmanship, and his role as craftsman, to be conscious of how this affects his view of prehistoric textile production.

The conclusion is that the participation of craftsmen is necessary for the further development of textile research, but the craftsmen have to deepen the source critical discussion connected to their specific kind of knowledge. The goal would be a synthesis of academic and craftsmanship knowledge. The Mons Claudianus project is an example of archaeologist and craftsmen working together. This cooperation has been fruitful both for reconstructions and publications contributing to textile archaeology, but perhaps more importantly by engaging the two forms of knowledge in discussion–and the development of the author into an academic craftsman.

Notes

1 Bender Jørgensen 2000; Bender Jørgensen & Mannering 2001.

2 Bender Jørgensen 2003.

3 Bourdieu 1979.

4 Hammarlund 1998.

5 Bender Jørgensen 1986.

6 Hammarlund 1998.

PART 2 PRODUCTION AND ORGANIZATION

4 Textile Tools and Production during the Viking Age

by Eva B. Andersson

The production of artifacts is a fundamental feature of man. Traces of this can be observed in the archaeological record in the form of waste products, tools, and remains of finished products. Some crafts, such as comb-making, bronze-casting, flint-knapping or pottery making, are more visible than others. This depends not only on the condition of preservation, but also other circumstances, such as research agendas, gender contexts, etc. The study of certain crafts is more acceptable and/or fashionable than other crafts. Textile crafts have generally been an invisible field in archaeology. This presumably is due to a focus upon textiles as a feminine, and thus marginal, research area, versus viewing textiles as a manufacturing process. Thanks to a clearer picture of the range and spread of textile products, we now have the opportunity to study textile manufacture and its organization during the Later Iron and Viking Age in Scandinavia.[1]

Apart from textiles themselves, the archaeological record comprises a large amount of textile tools, or remains of such, dated to the Viking Age (800–1050 AD). Spindle-whorls, loom-weights and bone needles are commonly found at excavations. Several types of tools were used to produce textiles, and within every implement group there have been variations affecting production. For example, yarn quality varies greatly between different textiles. This implies that spindles and/or spindle-whorls of various sizes have been employed. Thread count also indicates a demand for differently sized loom-weights. Varying cloth qualities suggest that needles of different thickness were used. All implements or parts of implements, recorded by their primary function and relevant for manufacturing processes, tell us about the production.

Introduction

Unfortunately, the Vikings are most famous for their plundering and raids all over Europe, but in Scandinavia, these people lived an everyday life, far from violence and war. The society was stratified. Most people lived in small villages and farmsteads, whose main subsistence would most likely have been of an agrarian or cattle-herding kind. Some prominent persons such as kings and chieftains often lived in large, single-managed farms. There were also other types of settlements, such as trading ports. In these places there is obvious evidence of both trade and specialized craftsmanship, in the form of gold- and silver-smithing, comb-making, etc.[2]

The Vikings also produced a variety of textiles: this paper is an attempt to show this complex world of textile production.

To understand the importance of Viking-Age textiles and textile manufacturing, we need detailed knowledge of original sources such as textiles, raw materials, and manufacturing tools, respectively. This also applies to the settlement sites in which these items were found, especially with regards to chronology and function. I will, therefore, start with a short overview of the textile needs of the Viking community, the raw materials and the textile implements in use, and then continue with a brief presentation of results based upon the registration and interpretation of textiles tools from a range of Viking Age settlements.

The Uses of and Needs for Textiles and Raw Materials

In the Icelandic Sagas, we read about men and women wearing different types of garments such as shirts, cloaks, trousers, shoes, gloves, etc. Clothing came in a variety of different forms and functions. It shows a range of purposes, from differentiating status to bestowing magical powers to being items of gift and exchange. And of course, the Vikings also had textiles in their homes, such as tapestries and table- and bedclothes. So the demand for textiles of different types and qualities (as today) was considerable during the Viking Age. Whether the settlement was large or small, textile manufacture for everyday use must have occupied a great deal of time, knowledge and ability. It is easily imaginable that several

people must have been involved in production.

The need for raw materials just to cover household requirements for textiles was quite substantial. The majority of raw materials used in Scandinavian textile production are wool and flax. Wool appears to have been more important in the prehistoric period. At the same time, it is very important to bear in mind that linen is very rarely preserved, and the lack of linen is perhaps, above all, a problem of source material. The same problem concerns the use of nettle and hemp fibers.

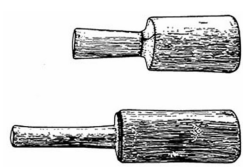
Fig. 4.1 : Reconstructed wool combs.

The wool was plucked from the sheep and sorted into different fiber groups, and then often combed with wool combs (Fig. 4.1). After that, the wool could be spun. For flax, after it had been harvested–that is, pulled by the roots and the seeds rippled–it had to be retted. The stems could either be placed in water or spread on the ground. Moisture assisted in the process of dissolving pectin between the bunches of fiber within the bark and the stem. The next stage was breaking, when a wooden club (Fig. 4.2) was used to break the stem and bark from the fibers. After that, at least in historic times, the flax was scutched with a broad wooden knife, which scraped away the last remains of stem and bark. Finally the fibers were hackled, or combed, with the aid of a tool, which, like a wool comb, had long iron teeth.

About 6 kg of raw material, wool and/or flax, were needed to make two complete Viking Age costumes, one female and one male (Fig. 4.3). This estimate is based on reconstructed Viking Age costumes made at the Historical-Archaeological Experimental Centre in Lejre, Denmark. The reconstructions are based primarily on findings from Hedeby.[3] Some of the garments were made from machine-spun yarn, which was usually lighter than spindle-spun

yarn. If made from handspun yarn, their weight presumably would have been higher. The manufacture of ten new sets of garments would, consequently, require over 30 kg of wool. If inhabitants at Hedeby produced 300 new outfits each year, they would have needed about 900 kg of raw material.[4] Icelandic historical sources from the beginning of the 19th century inform us that one ewe would provide 1–1.25 kg of washed wool, a wether, 1.75–2.5 kg.[5] Although of later date, this information may serve as a basis for calculations of Viking Age wool yields. Thirty kg of wool would correspond to 12–30 sheep, and thus 900 kg wool to 360–900 sheep. It is important to note that fleeces are not homogeneous, and each would have been sorted according to different purposes.[6] However, according to osteologist Elisabeth Iregren, Viking Age sheep were smaller than those of the 19th century.[7] Sheep sizes differed considerably in various parts of Scandinavia.[8] This meant that the number of sheep would have been considerably higher than our example, especially if selected qualities of homogeneous wool were desired. The estimate is thus a minimum of the sheep needed.

Fig. 4.2 : Flax clubs.



The Vikings also needed other types of textiles such as sailcloth. Marine archaeologist Erik Andersen has argued that about 1,000,000 m2 of sailcloth were in use during the 1030's.[9] This estimate includes the Danish navy as well as vessels for trade, fishing, transport, and communications. It also includes spare sailcloth for repairs. A large longship (30 pairs of oars) carried a sail of around 100 m2.[10] Sails must have been considered just as valuable as ships. For example, the only time in literature a man was ever said to have cried was in the saga of Saint Olav, which mentions a man who wept after losing his sail.

The main raw material for sails was presumably wool. The use of woolen sails can be traced up to the 19th century in the Faroe

Islands and Iceland. Their size was adapted to that of the vessel, as was the cloth and the quality of the yarn. Sailcloth varied in weight between 500 and 1000 g/m2. According to Erik Andersen, Icelandic sources from the 18th century inform us that around 75 pounds was needed for a sail of 16 m2. It took 30 weeks to comb the wool, spin the thread and weave such a sail.11

Hypothetically, for a sail of 100 m2, weighing 750g/m2, at least 75 kg of wool would be needed. If one kg of useful wool is available from one sheep, and the wool were sorted into three fiber groups (as it is today), of which one was useful for sailcloth wool, approximately 225 sheep would be needed. Several reconstructions of wool sails have been produced in recent years. They have proved fully seaworthy and equal the quality of sails made of linen, hemp, or even synthetic fabric. Tømmervik Textile Trust in Norway has produced three such sails. Made of wool from double-coated 'primitive' sheep, warp yarns were spun solely from the long hairs of the outer coat. To do this, access to wool from no less than 2,000 sheep was needed. The total weight of 100 m2 of finished sail (including smearing) was 140 kg.12 There is a huge difference between 2,000 sheep and 225 sheep; this illustrates the problem of calculating amounts of raw material. We do not have the skills, knowledge or conditions of the Viking Age. It is important to develop this discussion, and to gain knowledge of sheep and sheep farming. Osteology may prove a valuable source of information with regards to these problems.

Male costume	Weight	Weaving technique	Threads/cm
Mantle	1400 gr	2/2 twill	9/9
Over-tunic	880 gr	2/2 twill	19/11
Kirtle	430 gr	2/2 twill	8/8
Trousers	380 gr	Diamond twill	12/12
Leggings, 3.6 m	135 gr	Chevron twill	22/11
Total weight 3.325 kg			

Female costume	Weight	Weaving technique	Threads/cm
Mantle	1200	2/2 twill	9/9
Brace dress	450 gr	Diamond twill	14/12
Kirtle (wool)	430 gr	2/2 twill	18/18
Leggings	170	2/2 twill	11/7
Total weight 2.250 kg			

Total weight of one male and one female costume: approx. 5.5 kg

Fig. 4.3: Estimated amount of wool for one male and one female

costume, based on finds from Hedeby. When thrums are included, the total weight is approximately 6 kg.

Tools and Techniques

Spindles and Spinning

The most frequently-found spinning tool from the Viking Age is the spindle. A spindle consists of a whorl and a rod. The spindle-whorls uncovered in archaeological excavations vary with regards to material, shape, and size (Fig. 4.4). They were usually made of stone such as sandstone, fired clay, or bone, and whorls of other, more exotic materials such as glass and amber have also been found. Studies have shown that the shape and height of the spindle-whorls depended upon what material was used for the production of the whorl. For example, whorls made of clay are almost conical or double conical, while whorls made of stone are almost flat or hemispherical.[13]

Fig. 4.4: Spindle-whorls from sunken-floored huts, Scania. Each group of spindle-whorls is found in a specific sunken-floored hutt.

Spinning experiments have taught us that small whorls were used to spin a thin thread and a heavy spindle was used to produce a thick thread. An experiment with a spindle weighing five grams shows that the quality of the spindle-spun yarn is equal to that of modern worsted yarn. Even small increments of five grams can influence what thread one produces, but of course, the quality of thread still also depends upon the fiber material used.[14]

The Warp-Weighted Loom and Weaving

The type of loom that has left traces in the Scandinavian archaeological record is the warp-weighted loom, for clay loom-weights are often found (sometimes whole, but mostly in fragments (Fig. 4.5). The loom is upright and the warp is kept taut by loom-weights. The width and length of the warp are determined, above all, by the desired dimensions, with the size of the loom limiting the width. Data from Iceland show that a piece of cloth woven on a warp-weighted loom could be about 12.5 m long.

Fig. 4.5: Loom-weight from a sunken-floored hut, Scania.

Variation in thread count also indicates a demand for loom-weights of different sizes and thus, loom-weights do appear in a wide range of sizes. Loom-weights from 0.3–0.5 kg were the most common until the early Viking period; from the period 900–1050 AD loomweights up to two kg appear alongside smaller sizes. There are no general differences between fired and unfired loom-weights.[15]

Other Tools

Other types of tools were in use during the Viking Age but with the exception of bone needles, they are seldom found at archaeological excavations. We know, for example, that the Vikings used different types of reels, needles (bone and metal), scissors, tablets for tablet weaving, weaving combs for tapestry weaving, weave beaters, etc. One of the reasons that they are seldom found is that they are made of organic material and/or metal, and therefore are not preserved.

Another reason might be that these types of tools were actually not very commonly used.

The Organization of Textile Manufacturing

Between 1994–1999, I was fortunate enough to be working on the registration and interpretation of textile tools from a range of settlements.16 These settlements were selected for the following criteria:

- They are well documented
- They date to the Later Iron Age/Viking Age
- They represent a variety of economic categories

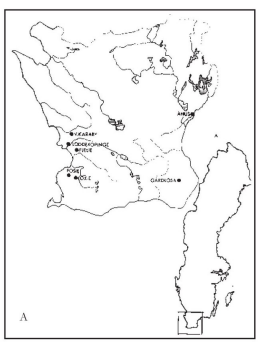


Fig. 4.6A : The location of the settlements in the study, Scania.

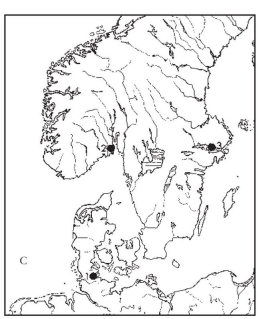


Fig. 4.6B : The location of hinterland settlements in the Mälar Valley. 1 Säby, 2 Valsta, Uppland, 3 Sanda, 4 Viby, 5 Pollista, 6 Säby, Södermanland and 7 the port of trade Birka (after Bennett 1987).

Fifteen settlements (Figs. 4.6A, 4.6B and 4.6C) are included in the study. Eleven of them were most likely agrarian. Two of the others are well-known ports of trade: Birka in Sweden's Mälar Valley and Hedeby in northern Germany. In both places, there is obvious evidence of both trade and specialized craftsmanship. (Fig. 4.7). The last two of the settlements are Åhus and Löddeköpinge in Scania, Sweden (Fig. 4.6A). Åhus, dated to the early Viking period, was a port, with evidence of both trade and specialized craftsmanship.[17] At Löddeköpinge, dated to the Viking period, no indication of specialised craftsmanship has been found, in contrast to the other ports of trade. Still, the settlement was obviously extensive and more densely populated than the ordinary agrarian settlements.

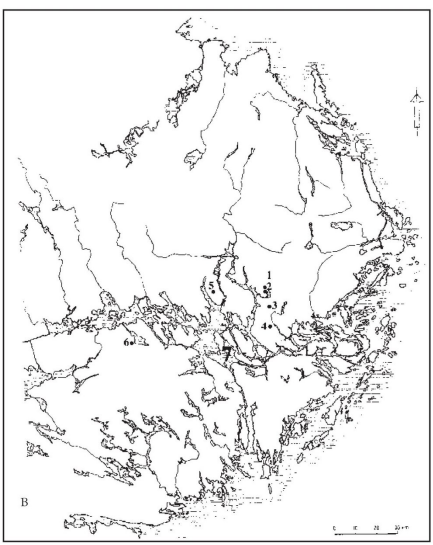


Fig. 4.6C : The location of the ports of trade. 1 Hedeby, 2 Kaupang (in Norway, not included in this study) and 3 Birka.

The Results

The study shows a striking difference between agrarian sites and the ports of trade, the quantity of textile implements being significantly larger at the latter (Fig. 4.8). Part of the reason may be

that populations at such sites were larger, and the need for textile tools consequently greater. Still, it is interesting to note that not only were the numbers of tools greater, but also the available selection of tools. It is quite clear that there was a more varied, and perhaps larger-scale, production of textiles at the ports of trade and Löddeköpinge.18

	Birka[1]	Hedeby[2]
Date	750–975 AD	808–1066 AD
Calculated settlement area	7 hectares	24 hectares
Excavated area	c. 6-7%	c. 5 %
Estimated population	300–400 (750-900) 100–1500 (900-975)	1000
Total number of registered tools	c. 2477[3]	c. 5344

[1] The information is based on Ambrosiani, pers. com.; Ambrosiani 1973, 122ff.; 1985, 107; 1991, 157; Ambrosiani & Eriksson 1996, 37ff, Andersson 2003.
[2] The information is based on Eckstein & Schietzel 1984, 181f; Schietzel 1984, 16; Steuer 1984, 343; Jankuhn 1986, 56ff; Andersson 2003.
[3] The registration indicates that the number of finds of textile tools increases during the 10th century. Twenty-six percent of the registered tools are dated to the early phase and 74% of the tools are dated to the later phase (Andersson 2003).

Fig. 4.7: Information concerning Birka and Hedeby.

One common feature of the agrarian settlements in the Mälar region and Scania is that the number of textile tools per settlement is small. At the agrarian settlements in Scania, most of the tools are found in sunken-floor huts. The sizes of the spindle-whorls indicate the conscious production of different thread qualities. With few exceptions, spindle-whorls found are of different sizes, undoubtedly to enable the spinners to spin varied types of thread. Loom-weights appear in a wide range of sizes, but they are not decorated. At the farmstead, the Vikings used the same clay for the loom-weights as for house construction, not the clay used for pottery. Except for bone needles, other types of textile tool are rare at the agrarian settlements.

At Birka and Hedeby, tools clearly fulfilled specific functional requirements, and many tools such as spindle-whorls, loom-weights and bone needles seem to be standardized. The homogeneous design of these tools suggests that they were made by a professional workforce.19

The spindle-whorls weigh between 3–135 g, but 76% of the whorls from Birka and 96% of the whorls from Hedeby weigh between 5–35 g (Figs. 4.9 and 4.10, which also include Åhus). The light spindle-whorls (less then 10 g) are frequent at ports, but do

not occur at agrarian sites. They also make up equal percentages of the total at Hedeby and Birka. These spindle-whorls can have been used only to spin very fine yarn. As mentioned before, experiments with spindle-spun yarn shows that the quality is equal to modern worsted yarn.[20] Such yarn was probably used for fabrics with a high thread count, or for a transparent, veil-like cloth. This contradicts earlier interpretations, in which all textiles of a consistently high quality were considered imports to Birka.[21] These results, of course, do not exclude the possibility of a simultaneous importation of textiles. Obviously, silks found in graves at Birka must have been imported. If specialist products were manufactured at Birka and Hedeby, the work must have been organized, perhaps by a patron or king. The craftsmen must have been highly skilled, using raw materials and tools of superior quality.

Both Birka and Hedeby have yielded loomweights in a range of sizes. However, their fragmented condition makes comparisons difficult, and suggests a large-scale production of finely-spun yarn at these sites. The loomweights were, in general, of a finer quality than those found at farmsteads, and were made of potter's clay. It is interesting to note that some loom-weights from these places are decorated (Birka 12 % and Hedeby 30 %), and some of the styles of decoration are exactly the same. In conclusion the similarities between textile tools at Birka and Hedeby are so great that we may suggest similar modes of production.

The number of other textile tools is generally too small to allow further insights. But it is notable that both Birka and Hedeby have smoothing stones of glass, although there are more finds at Hedeby (Fig. 4.11). Birka has yielded numerous metal needle cases and scissors. At Hedeby, the number of preserved wooden tools is substantial, including spindles and tools for the preparation of flax.[22]

Fig. 4.8: The numbers of finds of spindle-whorls, loom-weights (whole and fragments) and bone needles in the study. LW = loom-weight.

Textile tools	Birka	Hedeby	Åhus	Löddeköpinge	Agrarian sites in Skåne. No. of settlements = 5	Agrarian sites in the Mäla settlements = 6
Spindle-whorls	429	939	95	32/62	54	19
LW Whole	70	520		13/49		0
LW Fragments	1406	3480	>35	84/63	>35	231
Bone needles	414	302		2/28	13	8

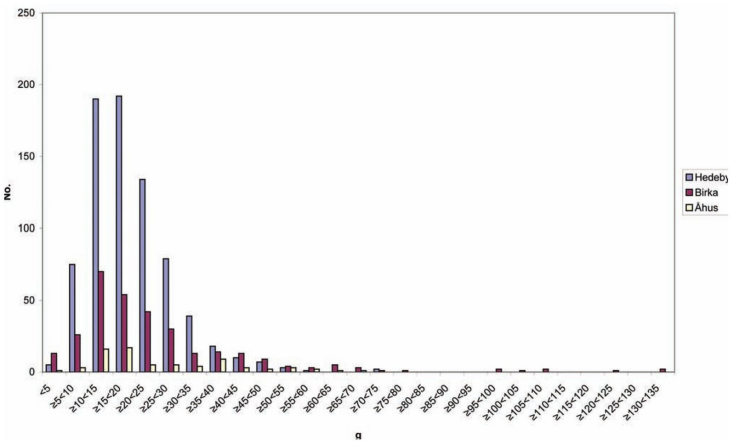


Fig. 4.9: Spindle-whorls from Birka, Hedeby, and Åhus, by weight, N = 1,136.

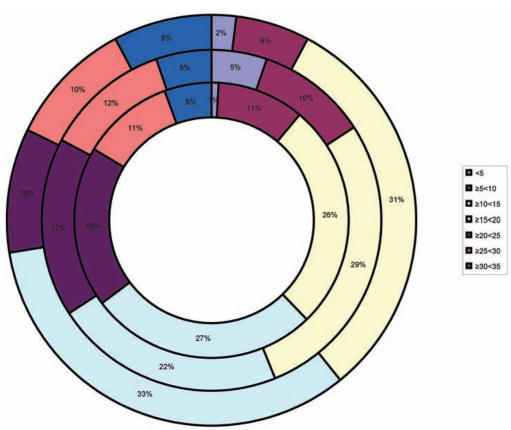


Fig. 4.10: Spindle-whorls from Åhus (outer), Hedeby (middle) and Birka

(inner), percentage per weight, N = 1,013.

Textile tools	Birka	Hedeby
Spindle-whorls	429	939
Loom-weights: whole	70	520
fragments	approx. 1,406	approx. 3,480
Bone needles	414	302
Needle boxes	140	0
Smoothing stones of glass	18	103

Fig. 4.11: A table of all the finds of larger groups of textile tools from Birka and Hedeby in the study.

Löddeköpinge, dating from the 8th century AD onwards, differs significantly from both the farmsteads and the other ports of trade. During the Viking Age, the Löddeköpinge settlement covered a very large area. Buildings consisted mainly of sunken floor huts, of which 129 have been excavated.[23] Textile tools frequently occur in the houses in increasing numbers, especially towards the end of the 10th century (Fig. 4.12).[24] Finds from the site indicate no clear specialization and no clear workshop areas. Since the settlement did not increase in size, the growing number of tools was probably not due to a growing population. Instead, it may be argued that the increase was caused by a demand for ordinary Viking Age textile qualities.

Near Löddeköpinge is a Viking Age ring-fort, Borgeby, that may also have been one Danish king's fortress.[25] Did political changes in the late 10th century and the early 11th century as well as a growing need for sailcloth cause the increasing textile production in Löddeköpinge? Near the Trelleborg ring fort in Denmark, where textile tools frequently appear, several settlements with sunken floor huts have been investigated.[26] It has been suggested that the huts were used for manufacturing sailcloth and clothing for the king's retinue. The increase in textile manufacture at Löddeköpinge supports this interpretation, and the sunken-floor huts in Löddeköpinge may well have served in this function. The inhabitants of these huts at Löddeköpinge would have produced textiles beyond their needs, as indicated by the number of tools and the increase in output of ordinary fabrics, during the 10th century. The most reasonable interpretation for this phenomena is that the products were sailcloth and other types of essential fabrics (cloth for the members of the King's court, tent cloth, etc.). [27]

Summary

The archaeological evidence supports the proposition that Viking Age textile manufacture had different levels of organization, and indicates that household production was considerably more extensive than thought before. Sailcloth production could have been organized as a household industry. Fine textiles could be seen as the results of specialist manufacture. This occurred only at the ports of trade. It is possible that farms of local magnates were included in this and I am convinced that textile specialists did work for patrons within their own homes. Unfortunately no major farm site was included in the study, something definitely worthy of further investigation.

Fig. 4.12: A table concerning sunken-floored huts in Löddeköpinge, with and without textile tools dated to the early, late and unspecified Viking period.

	Early Viking Age 800–900	Late Viking Age 900–1050	Whole Viking period	Total numbers
Total no. of excavated sunken-floor huts	67	52	10	129
Total no. of sunken-floor huts with textile tools found in floor layers	38	46	4	38
	56%	38%	40%	58%

Notes

1 See, e.g., Geijer 1938; 1965; 1980; Hald 1950; Hoffmann 1964; Hägg 1974; 1983; 1991; Bender Jørgensen 1986; 1992.

2 See, e.g., Ambrosiani & Erikson 1996.

3 In the port of Hedeby, Germany, there are several finds of textiles from both the settlement area and the burials. See e.g., Hägg 1974; 1983; 1991.

4 Andersson 1999; 2003; Andersson & Batzer forthcoming.

5 Adalsteinsson 1991, 286.

6 Wiklund 1984, 76ff.

7 Iregren, personal communication.

8 Vretemark 1997, 133.

9 Andersen et al. 1989, 12.

10 Andersen et al. 1989, 12.

11 Andersen et al. 1989, 21.

12 Lightfoot 1997, 15.

13 Andersson 2003.

14 Andersson 1996; 2003; Andersson & Batzer forthcoming.

15 Andersson 1996; 2003.

16 Andersson 1996; 1999; 2003.

17 Callmer 1991.

18 Andersson 1996; 2003.

19 Andersson 2003.

20 Andersson 2003; Andersson & Batzer forthcoming.

21 See, e.g., Geijer 1938, 40; Hägg 1974, 101; 1983, 206.

22 Andersson 2003.

23 Ohlsson 1976; 1985; Svanberg & Söderberg 2000.

24 Andersson 2000.

25 Bredsdorff 1972, 57; Holmberg 1977, 41–42.

26 Nielsen 1990, 152f.

27 Andersson 2000.

5 Spinning and Weaving at Tell Mardikh-Ebla (Syria): Some Observations on Spindle-Whorls and Loom-Weights from the Bronze and Iron Ages

by Luca Peyronel

Since the beginning of urbanization in north inner Syria, the textile industry was a key sector of the socio-economic organization of the first cities. The material from Tell Mardikh / Ebla presented here clearly demonstrates this, allowing us to follow the spinning and weaving evolution from the Early Bronze Age up to the Persian Period. A typological and quantitative evaluation of the spindle-whorls and loom-weights found during the excavations at Ebla is built up according to contextual and functional data. Finally, this large corpus of textile tools is considered taking into account the general technological changes in Syria-Palestine in a long-term cultural and historical perspective.

Introduction

The economic importance of the textile industry at Tell Mardikh-Ebla is well documented by the cuneiform archives from the Royal Palace G, dating from the Early Bronze (EB) Age IVA (c. 2400–2300 BC), which informs us about the palatial organization of textile workshops related to the Early Syrian kingdom of Ebla.[1] Archaeological materials (spindle-whorls and bone implements) confirm the epigraphic evidence and show the continuity of textile production also during the Middle Bronze (MB) period (c. 2000–

1600 BC), when Ebla was one of the most relevant towns in north inner Syria.[2] The discovery of two bronze spindles, thrown inside a *favissa* in Ishtar's Sacred Area, strongly suggests the symbolic value of textile equipment with respect to cults. Equally interesting is the presence of two spindle-whorls as funerary offerings inside a tomb of the Royal Necropolis (Fig. 5.1 and note 9). During the 3rd and 2nd millennia BC, the absence of clay loom-weights (with the exception of two possible terracotta conical weights) testifies to the use of the horizontal ground loom. A change in the weaving technology, with the introduction of the vertical warp-weighted loom, is witnessed by hundreds of clay loom-weights dating from the Iron Age II–III (Mardikh VB-C) and Persian period (Mardikh VI). In the latter period, a settlement was built on the Acropolis, centered around a public residence with an irregular trapezoidal shape and a central courtyard. Several building phases testify to continuous development for probably two centuries (end of the 6th to 4th centuries BC).[3] Textile manufacture is primarily evidenced by the large number of clay loom-weights and whorls found in the debris of the collapsed walls or directly on the floor levels of domestic buildings and residences. Several fragmentary bone spindles and spatulas represent other relevant classes of textile implements used during the 1st millennium BC at Tell Mardikh.[4] Groups of loom-weights *in situ* on the floors certainly indicate the original presence of the looms, and a large refuse pit has provided a great bulk of materials related to common households activities. (See Fig. 5.2 for the loom-weight context).

Fig. 5.1: Agate spindle-whorl from the Tomb of the Cisterns, Tell Mardikh-Ebla.

In this article a preliminary evaluation of the spindle-whorls and the loom-weights will be presented, whereas the other classes of textile implements are cited only in order to clarify specific

problems or emphasize significant archaeological association.[5]

Spindle-whorls

The spindle-whorls from Tell Mardikh-Ebla show the absolute predominance of plano-convex shapes and stone materials (especially limestone, basalt, siliceous stone and chlorite) during all chronological phases. It is possible to recognize a preference for small, high-domed or truncated-cone whorls (with masses clustered between 6 and 20 g) in limestone or basalt during the EB IVA period (Figs. 5.3–5.5). The 39 specimens come from the Royal Palace G scattered in several rooms of the complex.[6] This distribution seems to indicate that they are probably related to the 'common' spinning activity of the members of the palace, and not to the 'industrial' textile workshops cited in the administrative documents. It is very probable that in the workshops wooden spindle-whorls were employed, as suggested by the term *giš* (wood) before the word *bala* (spindle) in some texts.

The most common stone (limestone, basalt and siliceous stone) whorls during the MB period have a domed shape with a flat base, a perforation 0.4–0.5 cm in diameter and a mass of 10–20 g (Figs. 5.3–5.5). It is interesting to note that terracotta or clay whorls are completely absent during the Bronze Age (only some reused pottery sherds) and the few specimens dated to the 1st millennium BC can be dated to the very end of the Persian settlement or to the Hellenistic period. Flattened light bone whorls appear during the 2nd millennium BC, albeit in several cases it is difficult to distinguish between true spinning tools (used with composite shaft spindles) and buttons or other kind of objects.[7]

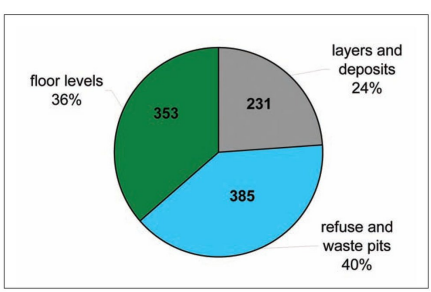
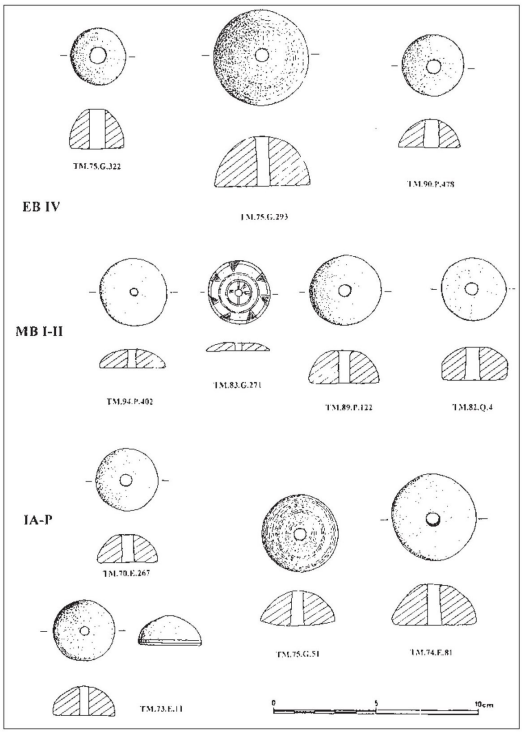


Fig. 5.2: Quantitative distribution of loomweights during the Persian period according to archaeological contexts.

In spite of the large number of excavations of the public and private buildings, only 55 whorls testify to the existence of a textile production at the site. They are widespread in several architectural contexts and cannot be ascribed to specific textile working areas. Therefore, the tradition of wooden whorls, albeit not testified by archaeological or epigraphic evidence, could also be the prevailing one during the Old Syrian Period. Two bronze spindles and two spindle-whorls from a *favissa* in the sacred area of Ishtar[8] and two beautiful spindle-whorls from the Tomb of the Cisterns, located under the floors of the Western Palace (which was probably the residence of the Crown Prince) (Fig. 5.1),[9] point to specific symbolic/ideological meanings of this kind of textile equipment, possibly related to the religious sphere of the main goddess of the city.

Over 80 domed stone spindle-whorls can be dated to the Iron Age III/Persian period. Most of them are in chlorite with masses clustered between 10 and 25 g and between 30 and 45 g (central hole 0.5–0.6 cm in diameter) (Figs. 5.3–5.5). The almost exclusive use of chlorite (local stones such as limestone and basalt are still employed, but in very low percentages) testifies without doubt to the existence of a specialized manufacture of small items (cosmetic flasks, beads and pendants, spindlewhorls, etc.); further, it perhaps reflects regular contact with the western regions, where the raw material is available on the mountain chains which separate the coastal strip from the inner plateau. It seems that for some reason during the Persian period, the chlorite workshop included the manufacture of spindle-whorls, which could be either as a replacement for or complementary to the wooden whorls.[10] Plano-convex shapes continue as the classic morphology, even though it is possible to recognize several sub-types (with convex or flattened bases, with straight sides, etc.) and other dimensional groups. A distinctive type is represented by medium-small whorls with one or two incisions near the base, which could be considered a product peculiar of the Syro-Palestinian area during the Persian period: specimens are found at Ras al-Bassit, Beirut, Sarepta, Tell Keisan, Tell ed-Duweir (Lachish), and Tell Jemmeh.

Fig. 5.3: Some examples of spindle-whorls from Tell Mardikh-Ebla according to chronological phases.



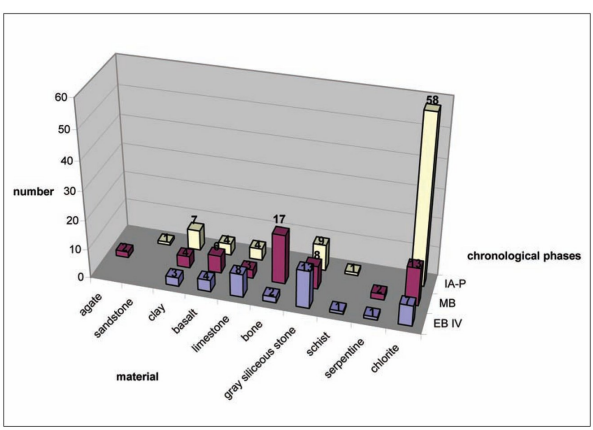
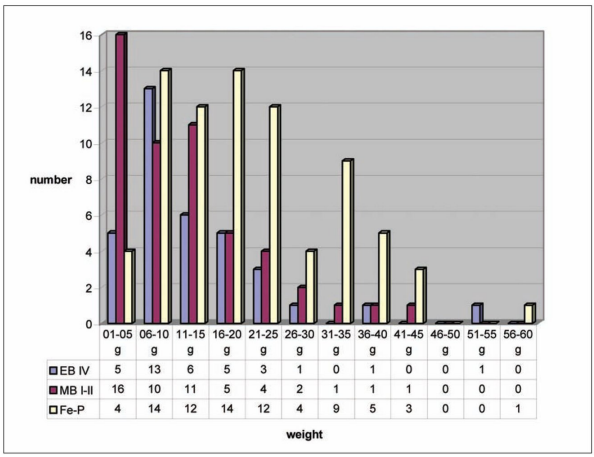


Fig. 5.4: Quantitative analysis of spindle-whorls–materials according to

chronological phases.



	01-05 g	06-10 g	11-15 g	16-20 g	21-25 g	26-30 g	31-35 g	36-40 g	41-45 g	46-50 g	51-55 g	56-60 g
EB IV	5	13	6	5	3	1	0	1	0	0	1	0
MB I-II	16	10	11	5	4	2	1	1	1	0	0	0
Fe-P	4	14	12	14	12	4	9	5	3	0	0	1

Fig. 5.5: Quantitative analysis of spindle-whorls according to weights and chronological phases.

Loom-weights

Only two possible terracotta loom-weights are present so far in the archaeological contexts dating from the EB IV–MB I–II (c. 2400–1600 BC) at Tell Mardikh. The specimens, which come from a level dating from the MB IB/IIA (c. 1900–1750 BC), are bell shaped, with a hole on the top, and weigh 303 and 322 gr. Although they could be counter-weights, door-stoppers or other functional items, the interpretation as loom-weights is strengthened if we look at the documentation of the Syro-Palestinian regions during the Middle Bronze Age. Groups of clay objects, sometimes with impressions of Hyksos scarabs, very similar in shape to the Mardikh specimens were found at Megiddo, Jericho, Gezer, Tell Ta'annek, Tell Ifshar and several other sites, raising the question of the introduction of the warp-weighted loom during the first half of the 2nd millennium BC in Palestine.[11] The presence at Tell Mardikh of these weights could be considered an important 'missing link' between Anatolia (where the vertical warp-weighted loom was used since the Neolithic period) and Northern Palestine. In the 'diffusion' of this

new kind of loom and its various technical potentials (although this loom never replaced the predominance of the horizontal ground loom during the Bronze Age), the role played by coastal and north inner Syria might be relevant, and we need a deeper investigation of the materials (unfortunately in most of the cases unpublished) coming from Western Syria.[12]

A sample of 981 clay loom-weights points strongly to a widespread use of the vertical warp-weighted loom during the late Iron Age and the Persian Period at Tell Mardikh. The weights are manufactured in local clay, usually unbaked or only slightly baked (with the exception of conical and pyramidal types, which are all fired). The clay is tempered with sand or chaff, pinkish or whitish in color. Surface treatment is found only in some cases, with a partial smoothing of the surface, and the only kind of decoration is represented in a small group of spherical/biconical weights by rows of punctured/combed lines.

A functional evaluation of this kind of object must consider, first of all, their weight and the diameter of the perforation. We can recognize four classes (A-D), crossing weights and hole-diameters without taking into account other morphological parameters. Moreover, a formal typology leads us to distinguish eight types (see Figs. 5.6–5.10).[13] Eight hundred thirty specimens (84.6%) are related to the spherical and biconical morphologies (with their flattened sub-types). These four types (1–4; abbr. S, Ss, B, Bs) belong, with few exceptions, to the same class of small and light weights with narrow perforations (class D), pointing to a homogeneous system of weaving with warp-weighted looms. Small groups of conical (with horizontal perforation), doughnut-shaped, pyramidal, and spherical/ biconical with punctured (combed) decoration weights are also recorded (types 5–8; abbr. C, TC, Ci, Dp).

The comparison of absolute values of the morphological parameters allows us to underline the following observations (Fig. 5.11).

Fig. 5.6: Iron Age and Persian period clay loomweights–typology and quantitative data.

Key to Class:

A 'large' weights (>100 g) with perforation >0.8 cm in diameter
B 'large' weights (>100 g) with perforation <0.8 cm in diameter
C 'small' weights (<100 g) with perforation >0.8 cm in diameter
D 'small' weights (<100 g) with perforation <0.8 cm in diameter

type	shape	abbr.	class	numb.	%	timespan
1	*spheroidal*	S	D	298	30.5	IA III/Pers.
2	*flattened spheroidal*	Ss	D	227	23.1	IA III/Pers.
3	*biconical*	B	D	230	23.4	IA III/Pers.
4	*flattened biconical*	Bs	D	75	7.6	IA III/Pers.
5	*conical*	C	B+D	17	1.7	IA III/Pers/Hell.
6	*tronco-conical/tronco-pyramidal*	TC	D	12	1.2	Hellenistic
7	*doughnut-shaped*	Ci	A+B+C	30	3.1	IA II/III/Pers.
8	*spher./bic. with punctured decoration*	Dp	D	31	3.2	Pers./Hell.
9	*unidentifiable shape*			61	6.2	
Total				**981**	100	

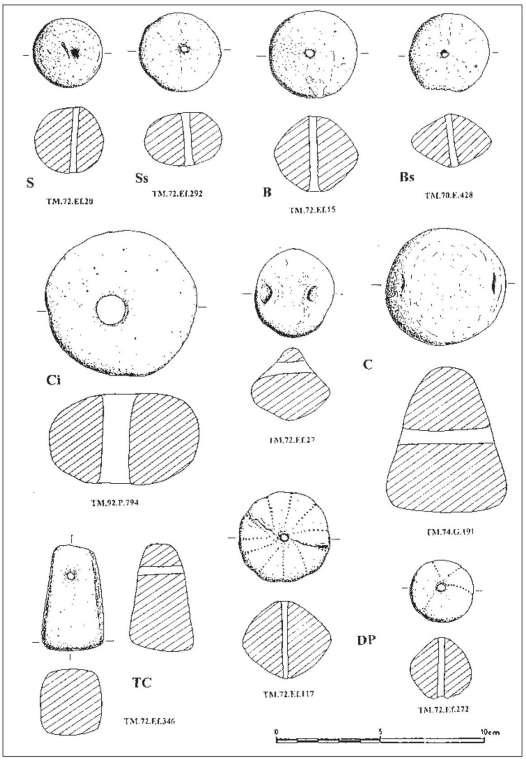


Fig. 5.7: Typology of the Persian period loom-weights from Tell Mardikh-Ebla.

- Weights S, Ss, B, Bs are very similar in means and limits of the morphological variables, suggesting that they are related to the same functional class.
- The holes' diameters cluster around 0.5 cm for the S, Ss, B, Bs, and C; types TC and Dp have means of 0.36 and 0.38 cm, respectively; doughnut-shaped weights (Ci) have perforations with a mean diameter of 1.2 cm. These differences are probably related to different weaving techniques (more threads tied to the Ci weights, versus two/three threads to the spherical/biconical specimens).
- The analysis of the absolute weight seems to indicate a strong standardization for Dp and TC (mean of 50.75 gr for TC and 26.95 gr for Dp). S, Ss, B and Bs can be considered as a same group with weights <100 g and means between 31.81 g and 37.25 g; the conical type has a mean of 68.06 g, and doughnut-shaped weights ranging between 63 and 512 g (mean 171.37 g), possibly belonging to two separate 'functional' groups.

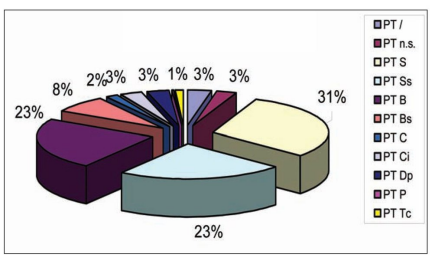
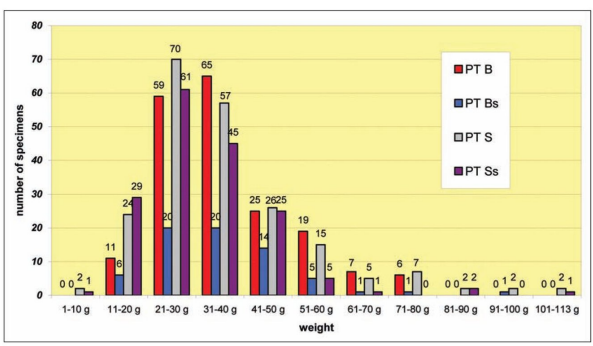


Fig. 5.8: Percentages of different types of loomweights during the Iron Age and Persian period.

This situation probably reflects a change in the fibers and/or in the kind of manufactured textiles during the late Iron Age and early Persian period in the Syro-Palestinian regions, as confirmed by the materials from Jerusalem (City of David), Khirbet Nimra, Tell el-Hesi, and Tel Michal, where the same kind of small spherical weights are the most common type.[14] On the contrary, during the preceding period (Iron Age II), heavier weights with a large central hole, usually called 'doughnut-shaped' (our type 7, abbr. Ci), represent the most common type in the same area.[15] The corpus of

Tell Mardikh both allows us to follow the change from the doughnut-shaped type to the spherical/biconical type and testifies to the limited use of the older type during the Persian period. The truncated-conical or pyramidal weight is certainly dated from the 6th century BC (with a continued use also during the Hellenistic and Roman times)16 and might be considered as a type which originated in Greece and penetrated the region through the colonies and entrepots located along the Eastern Mediterranean coast. Finally, the weights with combed decoration are probably a local variant of the 'classic' spherical weights, which have, to my knowledge, no parallel in the published documentation of weaving implements from contemporary Syria and Palestine. In spite of the spherical/biconical morphology of the Dp weights (very similar to the S-B types), the decorative treatment distinguishes this group from the others and could have been of 'functional' value to convey specific information, possibly indicating specific fibers/textiles, specific loom, ownership, etc.

Fig. 5.9: Iron Age and Persian period loom-weights–quantitative distribution according to weights and types (spheroidal, biconical, flattened spheroidal or biconical).



Summing up, it is possible to evaluate the Mardikh clay loom-weights of the Persian period as local and quite homogeneous, mainly consisting of 'light' and small spherical or biconical items (with their flattened sub-types). Together with these kinds of 'standard' weaving implements, we also find some peculiar and different morphologies, in a scanty number of pieces (<30), and

characterized by ‘functional’ parameters (C, Ci, and TC types) or by the only decoration known for this kind of object at Tell Mardikh (Dp type).

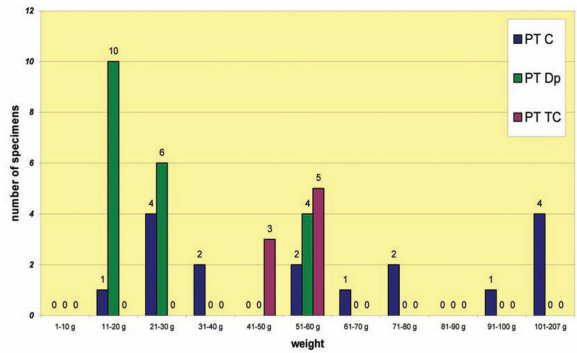


Fig. 5.10: Iron Age and Persian period loomweights–quantitative distribution according to weights and types (conical, tronco-conical, spheroidal/ biconical with punctured decoration).

Shapes Dimensional data	S	Ss	B	Bs	C	Ci	Dp
height – mean (cm)	3.21	2.71	3.28	2.80	4.80	4.28	3.13
height – limits (cm)	1.8–5.3	1.5–4.0	2.2–4.5	2.0–3.6	3.0–7.0	2.3–6.0	2.2–4.3
diam. – mean (cm)	3.62	3.80	3.89	4.08	4.49	6.57	3.26
diam. – limits (cm)	2.1–5.3	2.9–5.4	2.7–5.0	3.2–5.2	3.0–6.5	4.8–9.0	2.8–4.3
d. perf. – mean (cm)	0.47	0.50	0.45	0.47	0.48	1.2	0.36
d. perf. – limits (cm)	0.3–0.8	0.3–0.8	0.3–0.8	0.2–0.7	0.3–0.8	0.5–1.8	0.3–0.6
weight – mean (g)	36.11	31.81	37.25	35.88	68.06	171.37	26.95
weight – limits (g)	10–107	8–113	11–79	16–91	20–207	63–512	13–55

Fig. 5.11: Iron Age and Persian period clay loomweights–dimensional data by shapes.

Conclusion

Based upon the technological and typological parameters reflected by textile tools,[17] the evidence of the textile craftsmen in north-inner Syria as seen from the Eblaic point of view allows us to make long-term cultural and historical observations. The wide time span covered by the Eblaic specimens offers a picture which, starting from the peak of the second urbanization and continuing through

the Amorite kingdom of the first half of the 2nd millennium, ends at the Neo-Syrian period, finally linking to the Persian and Hellenistic periods. Each period was certainly characterized by specific and particular socio-economic features: from the strong and well-defined Early Syrian Eblaic state (EB IV) to the Old Syrian kingdom; from fully autonomous (MB I) to the control of the powerful Yamkhad reign (MB II) and then to the more regional perspective of the Iron Age village and of the rural settlement during the Persian period. However, the textile industry maintained a central role during all the chronological phases above mentioned and was linked more than once to crucial technological changes. During the Early and Middle Bronze Ages (c. 2400–1600 BC) spinning was done primarily using wooden whorls, as indicated by cuneiform texts and by the absence of archaeological material. There were a few small stone specimens found in the (EB) Royal Palace G, probably used by the high-ranking women living in the public building, and scattered evidence from the Middle Bronze levels. However the discoveries from cultic and funerary contexts seem to indicate the high symbolic value of these kinds of objects in the ideology and religious beliefs. Weaving on a large scale was certainly performed on ground looms, although two isolated terracotta loom-weights could be regarded as a clue for the introduction of the vertical warp-weighed loom during the Middle Bronze Age, taking into account the comparisons with other Syro-Palestinian sites. The missing link is still more or less missing in the following Late Bronze Age in the Levant, when the vertical weaving loom was introduced in Egypt, for we have very little data in the region to understand this crucial phase. A more thorough investigation of the coastal area and in the area north of Ebla might be decisive in solving this problem of the interaction between the system of the warp-weighed loom, seen in an interrupted sequence from the Late Neolithic up to the Iron Age in Anatolia, and the system of weaving on the ground loom, peculiar to the large urban settlements of the Syro-Mesopotamian regions during the Bronze Age.

At the very beginning of the Iron Age the widespread presence of doughnut-shaped clay loom-weights in Syria and Palestine and their associations with the warp-weighted loom is sure proof of a drastic change in the textile industry. This system seems to become the common one during the entire 1st millennium BC. The reasons for

this new development are difficult to pin down, though generally speaking, they should be linked to a 'revolution' in the socio-economic and cultural basis of the society. After the collapse of the 'international' political system of Late Bronze states, which comprised large cities around a palace, the emerging picture at the turn of the 2nd and 1st millennia was that of small 'national' kingdoms in which the political structure was founded on ethnic and blood ties. The large households or farms under direct or indirect palatial control disappeared or were completely redefined. The Iron Age production, and consequently also the textile working sequence, became segmented among several domestic households, albeit the different steps were probably performed (spinning and weaving) in the same 'spatial' area near or inside the houses. In other words, the general 'landscape' of the textile industry became greatly differentiated from the previous periods, when the centralization of finished products (in the palace or temple) and the dispersed allocation of manufacturing phases (in villages and hamlets around the cities, in distinct quarters of the town, in labour spaces inside the large public complexes) were the general trend. On the contrary, small towns and large villages during the Iron Age apparently concentrated textile industry to domestic units inside their 'urban' areas. The adoption of the warp-weighed loom, which could be also linked to interactions between different regions and persons–the Neo-Hittite and the Aramean or Neo-Syrian kingdoms representing a cultural continuum–certainly was encouraged by the 'space' in which the weaving was now performed. A vertical loom occupies a limited amount of floor space, can be leaned against the walls, or used in small courtyards. The looms can be concentrated in a smaller area, in comparison to the ground looms, as several IA settlements have shown in their distribution of clay weights.

Finally, another technical change can be identified at the end of the Iron Age III, or at the beginning of the Persian period, when small and lighter spherical/biconical weights (c. 30–100 g) substituted for the heavier doughnut-shaped weights. In this case, the change was caused by the introduction of new fibers and/or more refined manufactured products.

As a concluding remark, we would like to point out how important it is to take into account the craftsmen's activities, especially when trying to link a detailed analysis of the

technological and descriptive steps of the working sequence to a general socio-historical approach which evaluates ancient industries and materials.

Notes

1 For a discussion on the epigraphic data related to the textile production at Ebla, see in particular Biga & Milano 1984; Archi 1985; 1988; (administrative documents on textiles circulation) 1999; (systems of weight for wool and textiles) Zaccagnini 1986; (Semitic textile terminology) Pasquali 1997.

2 Matthiae 1985; 1989; Matthiae et al. 1995. For a synthesis of the most recent discoveries, see Matthiae 1997 and 2000.

3 On the Persian Period at Tell Mardikh, see Mazzoni 1984; 1990; 1991–92.

4 Cf. Peyronel forthcoming.

5 A study of all the tools and implements related to textile manufacture is presented in a volume of the final report on the archaeological materials from the Italian excavations at Tell Mardikh-Ebla: Peyronel 2004.

6 A similar distribution was observed also for bone pins, awls, needles and personal ornaments: Peyronel forthcoming, Tab. 1.

7 They are always domed and with a highly polished surface, and they weigh from 1 to 10 g, with a very small central hole (0.2–0.4 cm); the lighter specimens (from 1 to 3 g) could be also considered as buttons or some kind of decoration for furniture. These kinds of whorls became very popular during the Late Bronze Age, attested to in several sites from Anatolia to Cyprus to the Syro-Palestinian regions and they were also in use during the Iron Age. Their possible use as fly-wheels is suggested by their connection with spindles discovered in Megiddo tombs as funerary gifts. These very peculiar spindles consist of a decorated shaft divided in two parts with two whorls set with the flat faces. They were mounted on the rod with tenons fitted into holes in the ends of the two pieces of the shaft, see Guy 1938, Pl. 84:1 from Tomb 1122; Lamon & Shipton

1939, Pl. 95:38. This is quite a sophisticated and unusual typology, albeit more simple bone/ivory spindles without tenons with the same kind of incised decoration were also part of the textile equipment during the Late Bronze Age and the Iron Age. They occasionally have an elaborated edge shaped like a pomegranate, which can be either a separate part with a hollow in the base or the true edge of the shaft. Decorated rods considered spindles (or distaffs?) are also attested to Tell Mardikh during the Persian periods, albeit they were never related to bone spindle-whorls, which almost completely disappear in the documentation at that time (only 4 specimens). For a discussion of these kinds of implements, see Peyronel forthoming, with references to the Syro-Palestinian and Cypriote comparisons, and Cecchini 1992.

8 The bronze spindles come from the upper level of the *favissa* F.5238: they are simple rods circular in section and thinner at one end (0.4–0.7 in diameter). One specimen is broken and is 13 cm long, the second is intact (16.6 cm long). A small and low domed whorl/button with a 2.3 cm diameter, with the surface completely covered with engraved geometric patterns, and a limestone domed whorl were also found in the same *favissa*, albeit they are related to the lower level. These important specimens could be considered 'symbolic' gifts thrown inside the well during ritual festivity linked to the cult of Ishtar. The peculiar geometric decoration of one of the whorls, with hatched triangles, lines and circles incised on the flattened dome, is very rare during the MB in Syria-Palestine. For a detailed study of the *favissae* discovered in Ishtar's Sacred Area, see Marchetti & Nigro 1997; 1999.

9 An intact, beautiful, agate spindle-whorl (Matthiae et al. 1995, No. 429; Fig. 5.1) and a limestone flattened whorl were found as part of the funerary assemblage in the so-called 'Tomb of the Cisterns', one of the three princely hypogea found under the Western Palace Q, dating to the MB IIA. Like the whorls from the *favissa*, they could be symbolic, as spinning fibers was connected with the women's sphere of 'domestic' activities. For a description of the tombs and their funerary assemblages, see Matthiae 1979; 1980a; 1980b; 1980c; 1984.

10 This situation can be compared with Ras Shamra-Ugarit during

the Late Bronze Age, when the production of whorls attests to the wide use of chlorite: Elliott 1991, 41–45.

11 Artzy & Marcus 1995; Peyronel 2004, Chap. 4.2.

12 It is interesting to note that at Alalakh groups of ‘loom-weights’ in baked clay come from Levels XII to VII, although they were only mentioned and not illustrated in the publication: Woolley 1955, 23, 29, 405.

13 The abbreviations (S, Ss, B, etc.) are those used in the final publication and reflect the Italian names of the types; for their English equivalents, see here Fig. 5.6.

14 Cf. Bennet & Blakely 1989, 279–282; Herzog 1989, 358–359; Shamir 1996, 146–148; 1997.

15 See, e.g., Shamir 1996; Cecchini 2000.

16 Cf. Shamir 1996, 146–148; 1997 and 1994 for the Masada materials.

17 Here fly-wheels and loom-weights, but for a more comprehensive evaluation, see Peyronel 2004, Chap. 6.

6 Textile Industry and Minoan Palaces

by Pietro Militello

The review of both archaeological and textual evidence from Minoan Crete during the First and Second Palatial Periods (ca. 2000–1450 BC) seems to suggest that textile production was not organized according to a system similar to that of Mycenaean Crete, as emerges from the Linear B archives. Minoan Palaces were more textile consumers than textile producers; the Mycenaeans, instead, developed this traditional Minoan craft into a truly state-controlled industry.

Introduction

Thanks to the decipherment of the Linear B script, the studies by Ventris and Chadwick, Killen, Olivier, Melena and many others have demonstrated the attention paid by the Mycenaean Palaces of the 14th and 13th centuries BC to the whole productive chain in the textile industry from sheep-breeding through woolen production to cloth manufacture and distribution.[1] In the Linear B tablets of Crete we find flocks of hundreds of ewes, rams and wethers, with a calculated amount of 100,000 animals under Palatial control. A total of about 10,300 units of wool, i.e., 52,000 kg, processed by thousands of workers, and a production of about 5–7,000 pieces of cloth, 10 kg each, as it has been calculated, depict, as Killen said,[2] a state-controlled textile industry.

On the other hand, the importance of this craft has been recently reaffirmed also for the Minoan Palaces of the preceding period, both for the First Palace Period (2000–1700 BC) and the Second Palace Period (1700–1450 BC) (Fig. 6.1). Minoan textiles have been

considered an important item of trade for international exchange, and, as a consequence, an important element of Minoan Palatial economy, on the grounds of both indirect iconographic evidence[3] and more general considerations, such as the adoption of the warp-weighted loom or the precocious introduction of a murex shell industry for the production of purple dye.[4] This has been sometimes taken as proof of a substantial continuity between Minoan and Mycenaean organization of textile production, authorizing scholars to apply to Minoan Crete the same model as that of the Mycenaean state.

However, during these last years, several authors have stressed the differences between Minoan and Mycenaean politics,[5] applying to the former several models which substantially go back to the concept of 'early state' and reduce the extent of central authority.[6]

In this perspective, I will try to face the problem of the organization of a textile industry on Minoan Crete, by analyzing both the archaeological and epigraphic evidences in order to answer three questions: 1) Can the Mycenaean model of textile organization be applied to the Minoan Palaces? 2) What is the role of the Palaces in the textile industry of Minoan Crete? 3) What is the role of the textile industry for the Minoan Palaces?

Our review of the evidence will proceed according to the different phases of textile industry, from the production of raw material to the finishing of the products, which can be summarized in Fig. 6.2.

2000–1700 First Palaces	Major palaces at Knossos, Mallia, Phaistos.	Hieroglyphic and Linear A archives
1700–1450 Second Palaces	Major palaces at Knossos, Mallia, Phaistos, Zakros, Khanià (?), Kommos (?). Minor palaces at Galatas, Gournia, Petras, perhaps also Archanes. Minoan Villas.	Linear A archives
Ca. 1450 Mycenaean Conquest of Knossos	Palace at Knossos	
1380	Palace at Knossos	Linear B archive from the 'Room of the Chariot Tablets'
1380–1350 or 1200 (?) Mycenaean Crete	Palace at Knossos	Later Linear B archives at Knossos. Outside Crete, archives in Linear B at Pylos, Mycenae, Tiryns, Thebes.

Fig. 6.1: Chronological table of Bronze Age Palatial Crete (MB and LB).

Phases of textile chain	Activities	Archaeological Record	Epigraphic Evidence: (Hieroglyphic and Linear A)
Raw material production and collection	Sheep breeding and plucking (wool) Cultivation and harvesting (flax)	Sheep bones	KN #65, 67 HT 38, 132, 136; PH 31; ZA 9, 22, 26
Raw material processing	Carding (wool) Retting (flax) Washing, dyeing	Not identified Vats, channels	Not identified
Raw material distribution	Distribution	Not identified	*AB 80 (LANA)* HT 12, 14, 110, 146 PH 3 KH 43,1
Textile manufacture	Spinning, weaving	Spindle-whorls; Loom-weights	*H163* in MA #103b 41 *AB 54, 164 (TELA)* HT 16, 20, 27, 38 HT Wc 3019 KH Wc 2036-2045, 2111
Textile distribution, consumption	a) Redistribution b) Trade c) Gift	Iconography	Nodules, roundels

Fig. 6.2: Diagram indicating the different phases of textile production and the archaeological and textual evidence on Crete.

Raw Material Production and Collection

The starting point of the textile chain of production is represented by the raw materials, the sheep for the wool and the flax plant for the linen. However, only sheep can leave material remains through their bones. Since these are found in the excavations, the evidence comes mainly from settlements, giving a highly biased picture, mostly related to the moment of meat consumption. In any case, the archaeozoological analysis at our disposal at Knossos and Ayia Triada shows that sheep were butchered at an old age, so sheep breeding was orientated to wool production.[7]

Written texts help us very little in filling in the archaeological gaps. For the period of the First Palaces, a few hieroglyphic archives (Petras, Knossos, perhaps Mallia, if it was not in MM III) and a Linear A archive, that of Phaistòs, still survive. The ideogram for sheep (OVIS *152) occurs only in two four-sided tablets from Knossos (#65 and #67), referring to single units. Nor are sheep, either male or female, frequently represented in the several Linear A archives of the Second Palaces. Only half a dozen tablets in a corpus of about 300 deal with some of these animals. The largest amounts are at Ayia Triada, tablet HT 136 where 30 sheep are

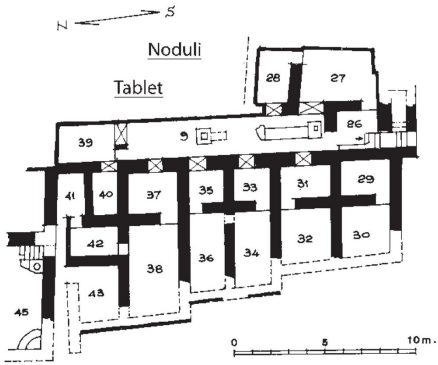
mentioned, and in Zakros, ZA 22, perhaps 100. These small numbers are not comparable to the flocks of hundreds of animals registered in the Linear B tablets, so the unavoidable conclusion is that our documents do not mainly refer to sheep breeding, but to sheep consumption, perhaps for meals. In the above quoted tablets, sheep recur together with other animals, and with wine, grain, figs, and also clothes. Consequently, our documents can be compared with Mycenaean tablets like Un 138 from Pylos, which have been interpreted as an entry of animals and foodstuffs for public banquets.[8]

We can say nothing about the cultivation of flax. The ideogram SA that in Linear B is interpreted as an abbreviation for linen is present in Linear A only a few times and in contexts which cannot be related to agricultural production.

Raw Material Processing

The shearing and washing of wool, picking of flax and treating of the fibers, because of their own peculiarities, might not leave any material traces. Dyeing needs among other things stone or terracotta basins and stone tools, which can leave some evidence. The problem in this case, which is not easily solvable, is to distinguish a use for textiles from others such as the treading of grapes or the pressing of olives, the decanting of olive oil or the must of the grapes, etc. On the other hand, crushed murex shells give a hint at the production of purple dye, which began on Crete very early, at the beginning of the 2nd millennium BC.[9]

Fig. 6.3: Plan of the South- West Quarter of Ayia Triada.



Raw Material Distribution

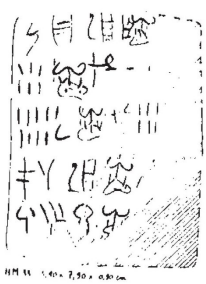
Archaeological evidence for the distribution of raw material is difficult to detect, while textual evidence is limited to a few Linear A tablets dealing with *AB 80 LANA (linen is not surely attested in Minoan texts), all of Second Palace date. A good image of collection/distribution can however be found in the Royal Villa at Ayia Triada. Here the finds from the SouthWest Quarter allow us to correlate both archaeological and epigraphical data. When the Villa was finally destroyed, around 1450 BC, a group of loom-weights was stored in Room 27 (Fig. 6.3). In the same area a transaction of delivery or of reception of goods was being carried out, testified to by the finding of a peculiar kind of sealing, called *nodulus*. In fact, they did not seal anything, but were probably used as tokens or receipts from an administrator represented by his seal. Forty-five of such *noduli* (Fig. 6.4) were found on the window sill which connected Room 27 to Room 9 and consequently with the outside. Moreover, one Linear A tablet came from this area. I was able to identify it as HT 24 (Fig. 6.5). This shows on its recto side the ideogram for wool (*AB 80 LANA), and on its verso that of the balance, the TALENTUM. Both sides of the tablets deal with the same product, wool, and as Hallager has shown, the total amount of wool on the verso is about four and a half *talenta*, corresponding to 45 units, 135 kg of wool. The correspondence between the 45 units of wool and the 45 *noduli* on the sill is striking.[10] At the time of the Villa's destruction, the administration of Ayia Triada was distributing or receiving 135 kg of wool and giving receipts in

exchange while a scribe was entering the data on his tablet. The looms stored inside Room 27 could be somehow related to this activity: perhaps they were to be used in the processing of the wool registered in the tablet.

Fig. 6.4: Nodulus CMS II,6,20.

Textile Manufacture

Spinning and weaving are the main activities through which wool and linen are transformed into finished cloth. Both activities can leave traces in spindle-whorls and loom-weights, even if these can also be made of perishable material. Furthermore, other information can be obtained from both hieroglyphic and Linear A texts, where a few ideograms have been identified as relating to finished cloth.



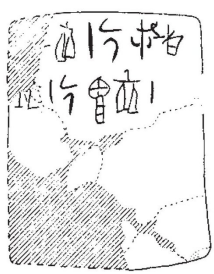


Fig. 6.5: Tablet HT 24 (from Halbherr notebook).

Fig. 6.6: Typology of Minoan loom-weights.

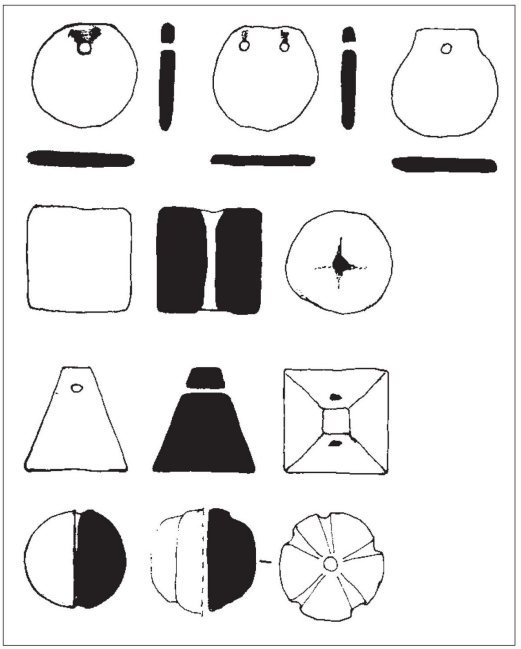
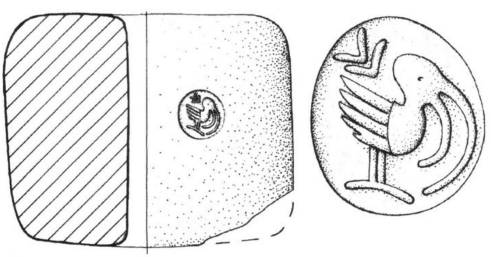


Fig. 6.7: Seal impression on a loom-weight from Phaistos.



In Crete, between the Middle Minoan and Late Minoan Periods, the evidence for spinning (spindle-whorls) is extremely rare, and often uncertain. On the contrary, the loom-weights are the best clue to the weaving phase. A lot of them, in a variety of shapes (Fig. 6.6), have been found in excavations, but generally, so far, they have not been adequately discussed in the publications.

As far as the First Palace Period is concerned, the most impressive finding is that of Knossos, the 'Loom-Weights Deposit'.[11] Four hundred tongue-shaped loom-weights which had fallen from the

upper floor were found in the East Wing of the Palace. They correspond to about 20 looms with 20 weights each and, if we consider two or three workers for each loom, a working staff of about 40–60 workers.

The same situation was found in Mallia in Quartier Mu, a real administrative complex whose relation with the nearby Palace is still uncertain. Here, there are 500 clay weights and 130 stone weights,[12] which correspond, in the excavator's opinion, to about 20 looms of 30 weights each, or, in my opinion, to 30 looms of 20 weights, with a working staff of 60–90 workers.

In the Palace of Phaistos,[13] about 60 weights have been found in the restricted excavated area of the First Palace. They were grouped in sets of about 12 units each, corresponding to 5 looms and 15 workers.

The evidence outside the Palatial centers is scarce, also because of the destruction of the Middle Minoan strata of many sites where life continued till Late Minoan I and also later on. It is worth mentioning the workshops in Chamalevri, Tzambaka.[14]

An interesting element in this period is the presence of seal impressions or marks on some weights. This custom is present at Mallia and in Phaistos (Fig. 6.7).[15] The purpose of these stamps has not been explained. They do not have a decorative value, as they are hardly visible. Nor do they seem to have functioned as indicators of specific weight measurements, due to the difficulty in obtaining an exact weight when baking a clay object. More probably, marks and impressions were used to identify the owner or the receiver of the set. Regardless of interpretation, they testify to a direct interest of the Palace and consequently a control system.

In written documents, the ideograms linked to weaving can be recognized in the hieroglyphic signs *H 041 and *H 163, and in Linear A syllabograms AB54 and AB 164. For the First Palaces, no evidence is attested in Linear A, while the corpus of the hieroglyphic Inscriptions of Crete quotes only two occurrences of these ideograms, both in Mallia (H 163 in a medallion (# 103 b), H 41 on a four-sided bar). In neither of the two cases is there any indication of quantity.

For the period of the Second Palaces, the documentation

increases enormously, especially in relation to the number of the surveyed sites. Among the Palaces and the private houses of the towns, a new kind of building appears, the so-called Villas (mansions or country houses), which have an important religious, economic and administrative function. [16]

The analysis of the finds distribution allows us to reach the following conclusions as far as distribution and manufacture are concerned:

1. Inside the towns, loom-weights can be detected in only a few houses. As a consequence, we must conclude that only some households owned a loom. As opposed to spinning, in fact, weaving requires relatively expensive installations and also a technical competence that not everyone had. This situation has ethnographic parallels. In Tell al Hiba, in South Iran, 'the weaving is made regularly by only one or two women in each village because of their acknowledged skill. Their community-wide status is greater than that of the ordinary woman, they wield considerable influence in their individual villages on the moral fabric of village life, and they can buy or sell wool and carpets.'[17]
2. Inside the traditional Palatial structures, the presence of loom-weights and installations related to weaving is very scarce. For Knossos and Phaistos finds are totally lacking. Loom weights are found in Quartier XII in the Palace of Mallia, while in the Palace of Zakros, one or two looms were placed in the area above rooms II-VII and in the South-West Quarter.[18]
3. The major evidence comes from the small palaces and from the Villas. At Ayia Triada three areas show a particular relation to textile production. Outside the citadel, inside the *Settore Nord-Est*, the house of the *Mazza di Breccia* included an accurately built central body, and an outlying annex of rooms, probably on a single floor, which functioned as workshops for the production of stone vases, for woodworking and for weaving activities. Inside the citadel, a house has taken its name from the clay globular weights here discovered (*Casa delle Sfere Fittili*). But the bulk of the material was found inside the so-called Royal Villa, especially in the SouthWest Quarter and in the North-West Quarter. In

Galatàs, at the end of Late Minoan IB, a whole, big, rectangular building acts as a workshop for the processing of agricultural products and weaving.[19] In Archanes, Tourkogheitonià, identified by the excavators as a Palace,[20] the presence of an administrative center is confirmed by the discovery of a tablets archive. Here a large group of loom-weights have been found in at least three areas: Area 3, Area 17 and Area 19. They come from the upper floor and are associated with large amounts of finds, inner rooms with wall paintings and other sophisticated architectonic elements. In Kommos, loom-weights come from four houses of the Second Palace period town and from Room 29 in the central building, Building T. The latter was a massive public construction. According to the publisher, Dabney, the data show that 'textiles were manufactured for use as trade goods or sailcloth for ships as well as for local domestic needs during the Late Minoan I period.' [21]

4. Consistent amounts of loom-weights have been found only in some of the 'Villas'. This element might confirm that, where present, the loom-weights are evidence for workshops, and not for household activities (the so-called Women's Quarter), as the excavators stated often. Actually, the Villas where the loomweights have been found, such as Vathypetro,[22] Sklavokambos, Tylissos, and Tourtouloi,[23] are often characterized by a strong productive aspect, confirmed by other craft activities (processing of agricultural products, etc.). In the House of Petràs,[24] many of the working processes of cloth-making (washing, dyeing and weaving) had probably taken place. On the other hand, the villas where there is no trace of the loom-weights, like Zominthos, Nirou Chani, Makriyalos, have a strong cultural and ceremonial feature.[25]
5. An odd context is seen in *Building 4* in the necropolis of Archanes, Phourni. In the upper floor of the East Wing, 45 globular and grooved loom-weights have been found, together with an installation for wine or oil pressing. The presence of a true production center inside a necropolis is not easy to explain; perhaps the looms served to make textiles for the dead.[26]
6. The use of marks and seal impressions on loom-weights declines in central Crete, while it is attested in Western Crete

and in Palaikastro, where a class of imprinted truncopyramidal objects, similar to the Hellenistic ones, is present. Their use as loom-weights, however, has been questioned by Weingarten[27] and Müller.[28]

7. Only a few Linear A tablets and roundels deal with wool (ideogram AB 80) and always in small amounts (HT 12, 24, 110, 146; PH 3; KH 43). In particular, HT 12 from Ayia Triada refers to 5 units (= 150 kg); PH 3 from Phaistos to about 12 kg. Units of clothes (ideogram AB 54) are mentioned in HT 16, 20, 27, 38; Wc 3019. The sign AB 164, interpreted as a peculiar kind of cloth, is seen in 11 roundels from Chanià, relative to deliveries of goods (KH Wc 2036–2045, 2111).

Textile Distribution and Consumption

Some of the tablets already dealt with refer to the moment of the consumption of the finished object, in this case the cloth. At this point, the best documentation is iconographical, showing on one hand the high level of refinement of the Minoan tradition (Fig. 6.8), on the other hand the different kind of use. The clothes could be for personal use, and they were probably part of the dowry of the women. Garments were part of cult activities, both as dress-vestments for the priests and priestesses and as dresses for the goddess (Fig. 6.9),[29] and therefore they played an important role in the Minoan imagery on seals and paintings.[30] Finally, the clothes could be used in the exchange system at different levels, both intra- and extra-site, at a private and at a more public level, since they were a means of exchange in the contemporary Near East and Egypt.[31] The evidence of their use as exchange goods at an international level has been determined by Elisabeth Barber in the circulation of decorative motives which would have been transferred from Crete to Egypt.[32] Burke put the early development of the extraction of the purple dye from the murex shell, attested on Crete before Syria, in relation with the supposed prestige inherent in the Minoan garments in the Western Mediterranean.[33]

Fig. 6.8: Ayia Triada, wall painting representing a goddess or a priestess (from Militello 1998).

Fig. 6.9: Seal CMS II, 6, 26 with the representation of a woman carrying a dress.

Conclusions

To summarize, a contrasting picture seems to emerge from the collected data. The long tradition and the high quality of Cretan craftsmanship make the elaborated ceremonial dresses a typical prestige item of palatial display. Moreover, an interest in this kind of production by the central authority is demonstrated, at least for the First Palaces, by seal impressions and marks. The great variety and specialization of Minoan cloth manufacture is also demonstrated by the compound signs for different kinds of clothes in Linear A. Two of these ligatures (TELA + *TE*, TELA + *ZO*) will be also found in the Mycenaean period, together with the ideogram for

wool, showing the strength of Minoan tradition. On the other hand, the spatial distribution of archaeological evidence does not hint at a centralized production. On the contrary, workshops and ateliers are often very far from the centers of power. The lack of strong central control is also evident in hieroglyphic and Linear A archives.

This apparent contradiction can be solved if we consider the Minoan Palaces as a place of cloth consumption, not of textile production. The palace was not interested in the basic stages of the textile chain of production (breeding and cultivation) but only in the final stages (weaving and manufacture), in order to fulfill its needs. Perhaps this fits better with the new view of the Minoan Palaces as an early state where, I quote from Driessen, the managerial and redistributive aspects that characterize the bureaucratic state are in operation but not yet fully developed.[34]

We can now answer the three questions we dealt with at the beginning of this study. 1) The Mycenaean model cannot be applied to the Minoan Palaces, since their structures was widely different; 2) The greater part of sheep breeding, flax cultivation, linen and fiber transformation, wool and linen processing, spinning and weaving, took place at a household level, outside direct Palatial control; 3) These conclusions, however, should not lead us consequently, to underestimate the importance of textiles for the Palace. Textiles constituted important items of display and of conspicuous consumption in ceremonial use, and were used as trade objects. We can apply to this case what Sherratt says in relation to trade: '…the quantities of goods… were undoubtedly small in their relation to the total production: but their importance was out of all proportion to their bulk.'[35]

Our data allow us also to propose a brief narrative of what could have happened. During the 3rd millennium BC a textile tradition developed on Crete, which was different in complexity and richness from the contemporary Egyptian and Near Eastern tradition. Thanks to their polychromy, Minoan clothes became appreciated in the Mediterranean and the Levantine area. With the rise of the Palaces, the need for prestige artifacts to be used in the complex network of competition, exchange and gifts inside and outside Crete caused this craft to develop and led to the creation of Palatial workshops. These, probably located initially inside the large central buildings, would not have been created for the production of a surplus. It is

probable that specialized craftsmen simply produced what people in the palace needed for private use and for ceremonial and diplomatic activity.

During the Second Palace Period, a general trend can be detected: the court-centered buildings were specialized in the ceremonial and religious function, while storage, industry, and administration were decentralized in the Villas. Manufacture was made at a household level or in independent workshops and the products were acquired by the Villas as tax, or in exchange for goods. Only at the end of the period is there evidence of a more centralized production, but in any case the evidence does not indicate an intensive exploitation of animal breeding and of a labor force as far as the textile industry is concerned.

The Mycenaean conquest of Crete, at the end of the 15th century, does not mean only the arrival of a new dynasty. It corresponds, on the contrary, to a more substantial transformation of the Cretan polity, and results in the birth of the bureaucratic states in the Aegean. The newcomers adopt the preceding administrative reality, the natural geographic subdivisions of the island and the hierarchical network of first-, second- and third-order centers, but they are put inside a new, coherent system. Perhaps, the new political rulers realized the high economic potential of textile production and decided to rationalize it. The transformation and reorganization of an old craft tradition into a real industrial chain of production began. The process was not immediate, since in the oldest archive in Linear B that we possess, the tablets from the Room of the Chariot Tablets, both sheep-breeding and cloth manufacture are only scantily represented.[36] We can also suppose that this transformation was due to a change in the textile role, from prestige craft to market item, or to an increase in the redistributive function of the Mycenaean Palaces, but that is another story.

Acknowledgements

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Notes

Due to the strong limits of space requested by the editors and to the general aim of the conference, bibliographical references are limited to primary source and fundamental publications. For the same reason, chronological indications are to be considered purely indicative. When not specified otherwise, we refer for the data to the general works dealing with Aegean textile production: from the pioneering unpublished doctoral thesis of Carington Smith (1975, see also Carington Smith (1991)) to the general survey of prehistoric textile by Barber (1991), to the specific analysis of the Aegean area by Tzachili (1997) and the until now unpublished thesis by Burke. A chapter is devoted to textile instruments in Evely 2000, 486–510. Texts and script signs are quoted according to the primary publications by Godart & Olivier 1996 (for the hieroglyphic script) and Godart & Olivier 1976–1985 (for Linear A).

1 Ventris & Chadwick 1973; Killen 1964; Olivier 1967; Melena 1975.

2 Killen 1985, 108.

3 Blakolmer 1994.

4 Burke 1999.

5 See, e.g., the different opinions in Driessen, Laffineur & Schoep (eds) 2002.

6 Driessen & Schoep (eds) 2002.

7 Bedwin 1984; Wilkens 1996.

8 Killen 1994.

9 Burke 1999; Alberti, this volume.

10 Hallager 2002, following a previous analysis by Palaima 1994.

11 Evans 1921, 253; Evans 1935, 678–680.

12 Poursat, Prokopiou & Treuil 2000.

13 Militello forthcoming.

14 Andreadaki-Vlasaki 1997.

15 Catalogue in Müller 1999; for Phaistos, see Militello 2002.

16 For a comprehensive discussion of the Villas and their function, see Hägg (ed.) 1997.

17 Ochsenschlager 1993, 50.

18 Platon 1988, 218–223.

19 Rethemiotakis 2002, 55–69.

20 Sakellarakis & Sakellarakis 1997.

21 Dabney 1995, 248.

22 Driessen & Sakellarakis 1997, 63–77.

23 Platon 1997, 198–199.

24 Tsipopoulou & Papacostopoulou 1997, 203–214.

25 Davaras 1997, 117–135; Koehl 1997, 137–149.

26 Deleghianne 1995.

27 Weingarten 2000.

28 Müller 1999.

29 Demargne 1949.

30 For representations on seals see Demargne 1949. In wall painting the offering of cloth to the goddess is represented at Thera, House of the Ladies, see Doumas 1992, 38, Fig. 7, and at Pseira, according to the new reconstruction by Maria Shaw 1998.

31 Barber 1991, 283–290.

32 Barber 1991, 311–357.

33 Burke 1999.

34 Driessen & MacDonald 1997, 70.

35 Sherratt 1991, 354.

36 Driessen 2000.

7 Flax and Linen Textiles in the Mycenaean Palatial Economy

by Françoise Rougemont

Flax is one of the oldest domesticated species in the Near Eastern regions: evidence from the end of the 8th millennium BC has been found both for seeds and for linen textiles–in Palestine (Ramad) and near the Dead Sea, in the cave of Nahal Hemar, respectively. In the Mycenaean world, flax was cultivated in Messenia and probably also on Crete (though the mentions are scarce) during the Late Bronze Age. We know from the Pylos and Knossos tablets that its fibers were collected and used to make linen textiles. It is designated either by the word ri-no*, /*linon*/, or by the syllabogram SA used as an ideogram (and probably an acrophonic abbreviation of a pre-Hellenic word for linen, unfortunately unknown).*

It is argued that the use of SA and RI corresponds to a difference in the stage of processing of the flax fibers: SA standing for flax fibers at an early stage (after uprooting or after retting), whereas RI would stand for the same fibers at a later stage (ready for spinning or even for weaving). The evidence for linen textiles and specialized workers is also reviewed.

Designations for Flax and Linen: Metrological Problems

Two syllabic signs are used by the Mycenaean scribes to designate flax/linen: the first one, *SA*, is attested both at Pylos and Knossos, in contexts connected with land plots. The Pylian tablet Nn 228, which bears both *SA* and the word *ri-no* (Greek *linon*, linen), as an explanation, allowed the identification of *SA* as a designation for flax/linen.[1] Another text from Pylos, Na 520, informs us that *SA*

was a designation for a plant (*pu2-te-re ki-ti-je-si*, 'the planters grow…'). The other designation used is the syllabogram *RI*, which was identified long ago as an abbreviation for the Greek word *linon*, also spelled *ri-no* on the tablets. The sign *ri*, alone, is also found as an abbreviation before some ideograms for textiles. The words *ri-no* and *ri-ta* are designations used in connection with different kinds of linen textiles.

The use of two different signs, *SA* and *RI*, should correspond to some practical difference. It is suggested that *SA* (which may be the acrophonic abbreviation for some unknown pre-hellenic word) represents flax stems just uprooted, or after retting, whereas *RI* would represent the fibers at a later stage of the process, e.g., flax fibers ready for spinning, or even linen thread. There is quite a strong argument in favor of the linen thread-hypothesis: on the Knossos tablet Np 7423, the word *ri-no* is followed by a numerical indicator of weight, the smallest unit used by the scribe being P, which is equal to 21 g. The number of P units is two, which brings the number to c. 42 g. This makes good sense if dealing with linen thread.[2] There is also a quantity of saffron recorded on the same document; this is another item weighed very precisely. Moreover, one may suggest that the saffron was used also to dye the thread or some textiles.[3]

One problem is that the item designated by *SA* appears to be sometimes counted (which means that the ideogram is immediately followed by numerals, without fractional quantities of any kind) and sometimes weighed (in this case, the ideogram is followed by metrograms and numbers). *SA* may, in fact, represent some kind of superior unit, as do the ideograms for grain (*GRA*), oil (*OLE*), or barley (*HORD*). The next question would be that of the absolute value of this unit. J. Chadwick suggested long ago the value of one talent, or 30 kg.[4] Another possibility, given that *SA* stands for raw material for the textile industry, would be to make a parallel with the wool ideogram (*LANA*), whose value is only 3 kg. There is no evidence in the documentation making it possible to decide definitively between the two possibilities. We do not find *SA* followed by a quantity higher than M3; moreover, in the Nc series,[5] quantities range from N3 to M3, which may be an argument for the hypothesis of a 3 kg value.

If *SA* is counted, and does not represent a superior unit, it could

be some kind of bundle or bale in which the fibers were usually packed. In this case, the evaluation of the weight becomes even more difficult. However, it should be remembered that in the Near East, flax fibers were delivered to specialized workers in handfuls (Akkadian *qatâtu*). It seems to be that of a logical quantity, for to extract the textile fibers from the cellulose, the stems must be beaten after retting. Data retrieved from experiments carried out recently[6] show that a handful of flax fibers, after retting, weighs around 130 g.

Unfortunately we do not possess the same kind of registers for the linen textiles that we have for the woolen ones, with production targets, and, consequently, the quantities of linen necessary for the fabrication of different types of cloth.[7]

Linen Textiles in the Mycenaean Texts: Overview

The tablets do not register the quantities of linen needed for the preparation of linen textiles, as said before. We only know some ideograms specified as *ri, ri-no* or *ri-ta,*[8] which indicate the nature of the fibers used. Different types of cloth are manufactured with linen thread. They are designated by means of ideograms, which are not always easy to interpret, as well as by words : *146[9] (M), *166 + *WE*,[10] *pa-we-a /pharwea/*,[11] TUN + *KI*, TUN + *RI*,[12] and *ki-to* (Greek */khitôn/*). On the whole, c. ten documents registering linen cloth or garments are preserved. They come mostly from the Knossos archives. *146 has been interpreted as some kind of garment. Nosch and Perna suggest convincingly that the interpretation of all the cloth designated by this ideogram as linen should be abandoned.[13] It seems logical that the precision *RI* was added only when the garment registered was made of linen, which means that all the other occurrences concern woolen garments. The cloth types designated by *pa-we-a* are also well known among the woolen fabrics. TUN + *RI* is also described by the word *u-po-we*, and the whole can be interpreted as a garment worn under the armour.[14]

The most problematic item remains the one designated by *166 + *WE*. The shape of this ideogram looks more like an ingot than a textile fabric. There are some variations in its shape: in two occurrences (see e.g., Oa 745), it is open on both sides; there is also

a variant with two strokes on one side.[15] Different interpretations of the *166 + *WE* variants have been proposed: *WE* may be an abbreviation for *we-a2-no*, */ wehanos/*, 'garment'; in this case the ideogram should stand for an item of clothing. Duhoux has suggested a kind of loin-cloth. If *WE* is an abbreviation for *we-a-re-pe/we-ja-re-pe*, 'unguent', *ri* *166 + *WE* may have been a linen cloth item treated with oil in order to become transparent, as suggested by Robkin.[16] This suggestion does not seem very plausible: first, it is possible, by means of weaving, to produce linen cloth which is quite transparent; second, the use of oil would more probably spoil the cloth by making it heavier, sticky and odorous.

The basic problem remaining is the shape of *166. If it stands for a textile item, then it must be strongly stylised.[17] Something like a spool or a rigid support on which thread or cloth may be wrapped could perhaps also be suggested. In two cases (both outside of the linen context), *166 is closely associated with *146, which is a garment. In these cases,*166 may have been some kind of complement to this item.

Specialised Workers in the Linen Cloth Industry

The last aspect of linen textile production in the Mycenaean palatial economy is the mention of specialized workers. Records of personnel at Pylos include occurrences of women qualified as *ri-ne-ja*, */lineiai/*, who were working with flax/linen. The context is an indirect one: the tablets register rations given to them and their sons. If we look strictly at the ideograms and persons registered, we have a total of four women (probably more, since the children are sometimes registered without their mothers being counted), 24 older boys, and 27 younger boys. They receive rations made up of wheat and figs. What is the function of these *ri-ne-ja* women? Were they working as spinners and/ or weavers, or were they processing the flax fibers through retting, beating, combing, etc.? If we look at other professional designations known from our texts for comparison, both possibilities remain open: for instance, *te-pe-ja* women were workers specialised in the fabrication of a specific cloth called *te-pa*, whereas some women qualified as *me-re-ti-ri-ja/-ti-ra 2* were specialised in the grinding of grain. In the field of textile industry, professional designation like *a-ra-ka-te-ja*, 'spinners', or *ka-na-pe-we* , 'fullers', are also well known.

There is no way to prove definitively the validity of one of these hypotheses over the other, but they may not be antithetic: it seems plausible that the *ri-ne-ja* women were processing the flax, perhaps beginning already from the retting, and then beating, combing, spinning and weaving. This would fit with the fact that (1) the palatial administration was encouraging the production of flax and acquiring this material through some kind of taxation[18] (the palace may have acquired directly both the fibers ready to be spun, and some ready-made linen textiles, which would have been made in the villages); (2) the possibility of the *146 garment being made of linen (*146 is acquired through taxation and was probably a kind of garment easily fabricated even at the local level, without much specialised skills being needed from the workers).[19]

Lastly, there is one document registering a man qualified as *ri-na-ko-ro*, 'linen collector'. The tablet does not give any insight into his work. It is simply a record of personnel, in which the precise scope is not clear to the modern reader. Perhaps this linen collector was commissioned to collect ready-made linen material on behalf of the palatial administration.

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Notes

1 On flax and linen, see Ventris & Chadwick 1973, 131, 159, 295, 392, 413, 430 and esp. 468–473.

2 Another possibility would be that of a linen item, but first, the weight would probably not be indicated so accurately, and second, we would expect to find the ideograms used for textile items. As a comparison, the weight of a fine linen tunic in Egypt seems to be around 300 g.

3 For this kind of use, a quite small quantity of saffron seems to be enough, see Nosch 2004. It is quite difficult to dye linen, but saffron can be used as a powder to color textiles.

4 Ventris & Chadwick 1973, 295, 368–373.

5 On these texts, see Perna 2003.

6 Médard & Jespersen forthcoming.

7 On this subject, see Killen 1984, and Nosch 2000. Some Mesopotamian texts provide detailed information about this topic: at Sippar in the Neo-Babylonian period, it seems that 750 handfuls of fibers (already combed and ready for spinning and weaving) were needed to produce 24 m of cloth. On this subject, see Joannès, 2001, s. v. 'lin'. Linear B texts do not provide such indications.

8 It is interesting to note that at least one 'collector', namely *e-me-si-jo*, is involved in the field of linen textile production, as shown by his appearance on Knossos tablet L (1) 8159, and maybe also (but only the first two syllables are preserved) on KN L (1) 5927. On the subject of 'collectors', see Rougemont 1999.

9 PY Un 1322, where the scribe also wrote that the garment is of the */wehanos/* type, and made of fine linen.

10 On KN Oa 745; for a drawing of the ideogram with the ligature, see Chadwick et al. 1986, I, 283. On the ideograms *165 and *166, see Lejeune 1971, 317–318.

11 One mention of *ri-ta pa-we-a*, linen *pharwea*, on KN L (1) 594.a. Also one on KN L (1) 5927.a. *ri-ta* alone, followed by a lacuna, appears on KN L (1) 8159.

12 Only one attestation of this ligature, on KN L 178.

13 Nosch & Perna 2001, 471–477. See also Perna 2003, 38–42, with an exhaustive bibliography on these problems. There is also a new reading by J. L. Melena, for PY La 622, where he reads *pe* *166 + *WE* (forthcoming in *Palace of Nestor IV*). The abbreviation *pe* in connection with textiles stands for *pe-ko-to*, */pektos/*, 'combed'.

14 Ventris & Chadwick 1973, 411, 589; Palmer 1969, 294, 461.

15 For drawings of this ligature on different documents, see Duhoux 1974, 116.

16 Robkin 1981.

17 See the complicated argumentation by Duhoux about how to fold a loin cloth to get a shape looking like this ideogram, Duhoux 1974, 117.

18 See Perna 2003, and Rougemont 2001.

19 Nosch & Perna 2001.

8 Cloth Production in Late Bronze Age Greece: the Documentary Evidence

by John T. Killen

The administrative records of the Mycenaean kingdoms of Crete and the Greek mainland, written in the so-called Linear B script on clay tablets, yield information on two broad categories of textile: first, fine cloth produced in state-controlled, specialist weaving workshops and, second, domestically produced textiles, acquired by the palaces by way of taxation. The paper discusses the detailed information the tablets provide about these fabrics, how their production was organised, and the workers who made them.

The Linear B tablets–the records of the late Bronze Age (Mycenaean) palaces in Crete and the Greek mainland, which we now have from six different sites, Knossos and Khania in Crete; Pylos, Mycenae, Thebes and Tiryns on the mainland–provide us with rich information on textiles and their production. Our fullest information on the topic comes from Knossos (c. 1360 BC?) and Pylos (c. 1200 BC), though we also have wool and textile records at Mycenae (c. 1250 BC) and Thebes (c. 1200 BC).

As the documents reveal, the economy of the Mycenaean kingdoms, at the time of the tablets, was of the same non-money, non-market 'command' or 'revenue' type as we find in other earlier, contemporary and later societies elsewhere, such as the Ur III Kingdom of late 3rd millennium Mesopotamia (2100-2000 BC) and

the Inca kingdom of pre-Columbian South America.[1] In the Mycenaean kingdoms, as in these other economies, the key rôle in the movement of goods and the employment of labour is played, not by a market, but by the central palaces with their elaborate storage facilities and record-keeping capacities. The palaces have the power to mobilise resources, mainly via a taxation system, from the extensive catchment areas which they control (in the case of Knossos, it appears, much of central and western Crete; in the case of Pylos, much at least of Messenia in the southwest Peloponnese); and they redistribute this revenue, which mainly consists of food and raw materials, to a large dependent or semi-dependent workforce: men, women and children who are engaged in 'industrial' production under the direction of the palace. Among the 'state' industries which are enabled to flourish by means of this redistributive process are metal-working, for which we have particularly good evidence at Pylos; perfumed oil (unguent) manufacture, which is attested at both Pylos and Knossos; chariot manufacture, also attested at both Pylos and Knossos; and the production of high grade textiles.

One of the most striking characteristics of the Mycenaean 'state' textile industry, at all the sites at which we have evidence for it, is the extreme degree of specialisation, or division of labour, within the workforce. At Pylos, for instance, we hear of *a-ke-ti-ri-ja*, *askētriai*, 'decorators (of cloth)', *a-pu-ko-wo-ko*, *ampukworgoi*, 'head-band makers', *a-ra-ka-te-ja*, *ālakateiai* (cf. later Greek *ēlakatē*, 'distaff'), 'distaff women' (spinners?), *o-nu-ke-ja*, 'makers of or workers with *onukhes*', literally 'fingernails', a kind of woollen decoration applied to cloth, *pe-ki-ti-ra2*, *pektriai*, 'combers (of wool or cloth)', *ra-pi-ti-ra2*, *rhaptriai*, 'sewing-women', *ri-ne-ja* , *lineiai*, 'flax or linen workers' and *te-pe-ja*, 'makers of *te-pa* cloth' (evidently a very heavy or large variety, possibly 'carpet').[2] Many of these descriptions recur at the other sites. It is clear that such a degree of specialisation could not have come about without the intervention of the palaces, which by providing the workers with their raw materials and rations enable them to pursue specialisms which in a market economy would require a very large and sophisticated market to sustain them. Indeed, once the palaces were destroyed, this specialist activity clearly ceased, and virtually all the terms which are listed above pass out of use in the Greek language.[3] It is not until a millennium later, in the great conurbations of the

Hellenistic and Roman periods like Alexandria, that we again find anything like the degree of specialisation in textile production that we find on the tablets, in that case sustained by a market economy.[4]

Df	1121 + 7689					(117)
.A	da-mi-ni-jo ,		OVIS^{m} 143	OVIS^{f} 36		
.B	ti-mi-za / ku-ta-to ,	*pe*	OVIS^{m} 21			
Dk(2)	1076 + 8052					(119)
.A		X	OVIS^{m} 200	LANA 33		
.B	ti-mi-za / da-mi-ni-jo			*o*	LANA 17	

Fig. 8.1: Tablets Df 1121 and Dk(2) 1076 from Knossos recording (i) a flock of sheep and (ii) the wool from these sheep.

We gain much our fullest and clearest picture of the workings of 'state' textile production in the Mycenaean world from the tablets from Knossos. Our evidence here begins with the 800+ records of sheep in the archive, nearly all of them certainly dating from a single year (the year of the destruction of the palace by a fire which baked the tablets hard, and thus preserved them for us).[5] Between them, these tablets recorded somewhere between 80,000 and 100,000 animals, mostly males. In the early days after the decipherment of Linear B in 1952, it was believed that these were records of animals being sent to the palace as tribute, doubtless for consumption. It is now apparent, however, that they record wethers (castrated males) and ewes which were kept for their wool. In a number of cases we possess not only a record of a flock itself, but also a tablet showing the target the shepherd was set for the wool production of the animals, and an indication of how far this has been met at the stage of writing the tablet. Targets of this kind for the wool–and lamb–production of flocks let out under herding contracts are a well-known phenomenon in other societies ranging from Mesopotamia in the 1st and 2nd millennia BC to England in the Middle Ages. Thus the Knossos 'flock' record Df 1121 (Fig. 8.1), written by Scribe 117, the author of the great majority of the 'flock' records, and found like all the rest of his output in the so-called Domestic Quarter in the east of the palace, records a flock of 200 sheep (143 males, 36 females and 21 further animals, possibly yearlings) allocated to a shepherd *Ti-mi-za* at a place *Ku-ta-to* in the central region of Crete; while the 'shearing' (or 'plucking') record Dk(2) 1076, written by Scribe 119, lists what is clearly the same

flock (here referred to in summary form as 200 male sheep, with the OVIS^{m} (male sheep) sign used in this instance to refer to a mixture of male and female animals), together with a note of its LANA (wool) yield thus far.

The LANA (wool) figure in line .A of Dk(2) 1076 shows the amount already contributed; the LANA figure in line .B shows the amount still owed (*o*). As on all other surviving 'shearing' records for flocks of this type, by this scribe and others, the amount delivered plus the amount in deficit (the target for the flock) adds up to a LANA figure of one-quarter of the OVIS^{m} figure. (Here it is 50 units, as compared with a sheep figure of 200.) Since we know (or think we know) the approximate weight of the LANA (wool) unit (c. 3 kg), we can calculate that the target per animal was c. 0.75 kg: a figure comparable with wool yields known both in ancient Mesopotamia and in Medieval England. And this, in turn, enables us to calculate that the total amount of wool at the disposal of the palace each year must have been of the order of 30–50 tons, depending on whether or not the deficits on the 'shearing' records were later made up.

Once it was available, this wool was supplied to the weaving workforce, some of which was located at the centre, Knossos, itself, but most of which operated in various outlying settlements in the central region of the island: at Tylissos, fairly near Knossos; at *Da-*22-to*, probably towards the west; at Phaistos in the south; etc. The Knossos archive provides us with a remarkably clear picture of how the production was organised in these various places.[6] The first stage is recorded on tablets, classed as Lc(1), by Scribe 103, the scribe *par excellence* of the central Cretan textile industry, whose work was found in the series of storage magazines in the west of the palace and the corridor in front of them. Lc(1) 527 is one of the better preserved of these records (Fig. 8.2).

The tablet begins with the name of the workgroup, written in large-sized signs: *e-ki-si-ja* , the women of *E-ko-so*, perhaps *Exos*. Then comes the cloth production target for the group: two units of the mysterious *pe-ko-to* variety of TELA+ *TE* or *te-pa* cloth (see above); almost certainly 19 units of the normal type of the same fabric; and two units of a cloth described as *tu-na-no* (sense unknown).[7] Then, following the target for each variety of cloth, comes a LANA figure showing the amount of wool which will have

to be supplied to the workers to enable them to carry out this particular task. Throughout these records, the cloth:wool ratios for each of the varieties of fabric remain constant: 1:10 (i.e., 10 units or c. 30 kg of wool per piece) for the *pe-ko-to* variety of TELA + *TE*, 1:7 for the normal variety of TELA + *TE*, 1:3 for *tu-na-no* TELA and 3:5 for *pa-we-a ko-u-ra, ko-u-ra* cloth (meaning again unknown), a variety not represented on Lc(1) 527.

Following the setting of the target and the calculations of the wool requirement comes the supply of the raw material. At least one tablet recording this stage in the production process has survived, Od(1) 562, which is again the work of Scribe 103 (Fig. 8.3).

Line 1 of the record begins with the phrase *o-pi no-nu-we*, 'at the workshop of (or under the supervision of) *No-nu*' : *N.* (a man) presumably being either the workshop supervisor or a palace official responsible for overseeing deliveries of wool. Then follows a record of three separate deliveries of LANA: '*A-ti-pa-mo* (another man) brings' (*pe-re, pherei*) 91 units of wool (l.1); '*Si-da-jo* (a second male supplier) brings' 42 units of wool (the term *po-ro-to* which follows *pe-re* here might be Greek *prōton* and a reference to the quality of the wool or the fact that this is the first of two or more deliveries) (1.2); and '*A-po-te* (a third male supplier) brings' 69 units of wool (l.3). Since we know that the normal variety of TELA + *TE* (equalling *te-pa* cloth) took seven units per piece to make, it is tempting to conclude that the first two deliveries, each of which involves a wool figure which is a multiple of seven ($7 \times 13 = 91$; $7 \times 6 = 42$), were designed for the production of this type of cloth; and this in turn leads one to suspect that the third delivery (69 units) was intended for the production of 2 units of *pe-ko-to* TELA + *TE* (the amount on Lc(1) 527), which would have required 10 units apiece, plus seven units of the normal variety of the same cloth ($2 \times 10 = 20$; $7 \times 7 = 49$; $20 + 49 = 69$).

Finally comes the delivery of the finished product to the palace or its local representatives, and this stage in the process is once more recorded on tablets by Scribe 103, found with both the Lc(1) 'target' and Od(1) 'wool supply' records in the area of the Western Magazines. These cloth delivery records are classed as Le; Le 641 is a large and well-preserved example (Fig. 8.4).

The fact that the tablet is solely concerned with cloth, with no wool mentioned, immediately suggests that it may record the final delivery stage in the production cycle; and this is confirmed by the opening phrase: *o-a-po-te de-ka-sa-to* : *hō a-po-te dexato*, 'thus (the man) *A-po-te* received'.8 Then, following two opaque terms towards the end of line 1, comes a series of entries, on lines 2–4, each of which takes the same form: first a reference to a group of women [*pa-i-ti-ja, Phaistiai,* 'women of Phaistos' on l.2, *da-wi-ja*, 'women of *Da-wo*' (a place in the south of the island apparently close to Phaistos) also on l.2, *ko-no-so / te-pe-ja,* '*te-pa* cloth workers at Knossos' (l.4), etc.], then a TELA (cloth) entry, always relating to the TELA + *TE* (equalling *te-pa*) variety of fabric. We can be in little doubt that these are the same workgroups and consignments of cloth as are dealt with on the Lc(1) 'production target' records by the same scribe. Not only are many of the same descriptions of women found in the surviving Lc(1) tablets, there is also complete agreement between the types of cloth found in the two contexts in connection with a particular group-name. Thus the women of *Da-wo* (*da-wi-ja*) are shown on Lc(1) 526 as expected to produce both the *pe-ko-to* and normal varieties of TELA + *TE*; and the *da-wi-ja* on Le 641.2 are recorded as delivering the *pe* variety of TELA + *TE*, where there can be little question that *pe* is an abbreviation of *pe-ko-to*.9 In contrast, the women of *Qa-mo*, the *qa-mi-ja*, are recorded on Lc(1) 543 as expected to produce only the unqualified variety of TELA + *TE*; and the *qa-mi-ja* on Le 641.3 are listed as delivering the same unqualified variety of the fabric (there is no *pe* before the ideogram). The numbers in the two contexts are also consistent with the hypothesis that Lc 641 records the receipt/delivery of some of the same textiles whose production is envisaged on the Lc(1) tablets. The texts of Lc(1) 526 (the *da-wi-ja* 'target' record) and Lc(1) 543 (the *qa-mi-ja* 'target' record) are set out below (Fig. 8.5).

Fig. 8.2: Tablet from Knossos designating production targets.

Lc(1)	527 + 7143 + 7331				(103)
.A	]	'pe-ko-to' TELA[1] + *TE* 2	TELA[2]+*TE* 1̣9	LANA	153
.B	]ẹ-ki-si-ja /	tu-na-no TELA[1] 2	LANA 6		

Fig. 8.3: Tablet from Knossos concerning deliveries of wool to a

workshop.

Od(1)	562		(103)
.1	]ọ-pi , no-nu-we , 'a-ti-pa-mo' pe-re	LANA 91	
.2	]si-da-jo , pe-re 'po-ro-to'	LANA 42	
.3	a-po-te , pe-re	LANA 69	

Lc	641 + *frr.*	(103)
.1	o-a-po-te , de-ka-sa-tọ , a-re-i-jo , o-u-qe-po[	
.2	pa-i-ti-ja , '*pe*' TELA+*TE* 2 *mi* TELA^{1}+*TE* 14 da-wi-ja , *pe* TELA^{x}+*TE* 1[	
.3	do-ti-ja *mi* TELA+*TE* 6 qa-mi-ja TELA^{1}+*TE* 1[	
.4	ko-no-so , / te-pe-ja '*mi*' TELA+*TE* 3 tu-ni-ja TELA^{1}+*TE* 1 [	
.5.6	*vacant* [ ] *vacant* [	

Fig. 8.4: Tablet from Knossos recording cloth deliveries to the Palace.

Though many of the surviving Lc(1) 'target' records are damaged, and others in the series have clearly not survived at all, we are fortunate in having two totalling records for these tablets, one with its cloth figures probably complete. This is Lc(1) 536, whose text runs as follows. (Fig. 8.6).

The totals here are: *pa-we-a ko-u-ra* (we can safely restore *ko-u-ra* before the TELA ideogram on l.1), 200 units; *tu-na-no* cloth, 48 units; *pe-ko-to* TELA + *TE*, probably 18 units (though we cannot be finally certain that there were not one or more hundred signs before 18); unqualified (equalling normal) TELA + *TE*, 267 units. There is also mention of a single tunic (*ki-to*, *khitōn*). This gives a total for the tablet of 534 units; and another 430 units are listed on surviving individual Lc(1) 'target' records which were probably or possibly not totalled on Lc(1) 536:10 making it likely that the original grand total for the series was 1000 + units of cloth.

Lc(1)	526			(103)
.A	]	'pe-ko-to'	TELA^{1}+*TE* 1[0] TELA^{2}+*TE* 14[	
.B	]dạ-wi-ja /		tu-na-no TELA^{1} 3 LANA[	
Lc(1)	543			(103)
.A			TELA^{1}+*TE* 11[	
.B	qa-mi-ja /		tu[-na-no	

Fig. 8.5: Two tablets from Knossos recording production targets.

Lc(1)	536 [+] 7383 + 7731					(103)
.A	]	'ta-ra-si[-ja'	]pa-we-a[	]TELA^{x} 200		
.B	]	'*vest* . [']	tu-na-no[	]TELA^{1} 48		
			a-ro-zo	'ki-to'	TELA^{1} 1	
.C	to-]sa /		pe[-ko-to	TELA^{1}+*TE*]18		
				TELA^{2}+*TE* 267		

Fig. 8.6: Tablet from Knossos totalling different types of cloth.

How many women workers were required for this production? Besides the cloth production records just described, we also have many tablets at Knossos, classed as Ak, which give detailed breakdowns of the various workgroups which are described merely in summary terms on the production 'target' and 'delivery' records: the women of Phaistos, the women of *Da-wo*, etc. Many of these personnel records are again the work of Scribe 103, though some are the work of other officials, Scribes 102 and 108. Ak(1) 634, for example, gives us the detailed breakdown of the group at *Se-to-i-ja* who are mentioned on the 'production target' records on Lc(1) 525 and on the 'cloth delivery' records on Le 654 (line 4) (Fig. 8.7).

Though the tablet is damaged, enough survives to enable us to say that the group consisted of at least 74 trained women (MUL), plus five adult apprentices (*di*).11 Also attached to the group are a number of children, probably–though not certainly–the women's own. Here there are 10 'younger' girls, *ko-wa me-u-jo-e, korwai meiwyohes*, and 5 (+?) boys, *ko-wo, korwoi*, described as *me*. We cannot be certain whether this abbreviates *me-u-jo-e* or its opposite *me-zo-e, medzohes*, 'older', which is also found regularly on the tablets. There is also reference on the record to what is probably a workshop supervisor, *DA*, who there is evidence at Thebes to suggest is a man. Many Ak tablets also mention a *TA*, who may be a female supervisor.12

Unfortunately, however, many of the Ak tablets are damaged, some very badly, and we cannot establish how many women and children they originally recorded. The surviving tablets appear to have recorded approximately 600 women and 450 children. We do, however, have another possible clue to the original total. In one case, both the Ak tablet relating to a workgroup and the group's cloth production target in the Lc(1) records have survived with their women and cloth figure intact (or intact enough to restore). The Ak record in question is Ak(1) 612, which shows that the *da-te-*

we-ja workgroup consisted of nine adult women (MUL) and three children (one older and one younger girl, one older boy); and the corresponding 'target' tablet is Lc(1) 540, which almost certainly records a requirement of 9 units of *pa-we-a ko-u-ra*13 (Fig. 8.8).

Nine women on the Ak tablet and almost certainly nine units of cloth on the Lc(1) tablet make it a virtual certainty that the standard production target for *pa-we-a ko-u-ra*, for whatever period it was that the Lc(1) records cover, was one unit of cloth per adult weaver: though we cannot be certain that the same target applied to the other varieties of fabric mentioned on the Lc(1) records. If, however, we assume an average of one weaver per piece of cloth recorded on the 'production target' tablets as a whole, 1000+ adult weavers will have been required for the 1000+ units of cloth likely to have been recorded in the series.

Fig. 8.7: Tablet from Knossos giving a breakdown of cloth production workers by sex and age.

Ak(1)	634 + 5767							(103)
.A			[ ]'*DA*1 ' [ ]74[ ]			*di*	5 [	
.B	ṣẹ-ṭọ-i-ja / ko-wa , me-u[-jo-e]	10		ko-wo	*me*	5[		
lat. inf.		*vac.* [				]	ru-si[	

Fig. 8.8: Two tablets from Knossos, Ak(1) 612 giving the breakdown of a particular workgroup, while Lc(1) 540 + 8075 shows its production target.

Ak(1)	612							(103)
.A			*TA* 1	'*DA* 1'	MUL 9			
.B			ko-wo ,	/ me-zo 1			ko-wa / me-u-jo 1	
.C	da-te-we-ja / ko-wo	/ me-zo 1			[[ko-wo / me-		]]	
Lc(1)	540 + 8075							(103)
.A			'pa-we-a' ko-u-ra		TELA[1] 3[			
.B	da-te-we-ja /						[	

.A 3[: arrangement suggests 9.

What became of the cloth on the Lc(1) tablets after its delivery to the palace, or the palace's local representatives?14 It is a curious fact that all the cloth recorded on the surviving Le 'delivery' tablets is TELA+*TE* (equalling *te-pa*): there is no trace of the two other

varieties found on the ‘production target’ records, *tu-na-no* and *pa-we-a ko-u-ra* (both denoted by TELA, the ‘plain’ or unsurcharged form of the cloth ideogram). It is also striking that all the cloth found on the main group of records of bales of cloth in store in the palace, the Ld(1) tablets written by Scribe 116, is described as *pa-we-a* (and is again denoted by ‘plain’ TELA): there is no trace of TELA + *TE* in the series (or, indeed, on any other records in the archive which appear to relate to stores). A typical Ld(1) tablet, Ld(1) 573, reads as follows (Fig. 8.9).

What appears to lie behind these facts is that after its manufacture the cloth produced by the Lc(1) workers was treated in two different ways. Whereas the heavy or large TELA + *TE* appears to have been delivered directly to the palace or its local representatives, there is much to suggest the lighter or smaller *pa-we-a ko-u-ra* first went through a separate finishing process, before ending its career as the *pa-we-a* on the Ld(1) ‘store’ records. Not only are the figures for *pa-we-a ko-u-ra* (TELA) on the Ld(1) tablets, so far as we can establish them, consistent with this hypothesis: a number of the terms which appear on the Ld(1) tablets, like *e-ruta-ra-pi* , *eruthrāphi*, ‘with red attachments’ and *re-u-ko-nu-ka*, ‘with white *onukhes*’, woollen ‘nail’ decoration, on Ld(1) 573, refer to decorative appendages to the cloth and are not found on the Lc(1) tablets. This would be explicable if there were a separate finishing stage for *pa-we-a* (*ko-u-ra*) at which these appendages were added to the fabric. And further support for this hypothesis appears to be provided by a number of records, also classed as Ld(1) and written by Scribe 116, which record the delivery of ‘plain’ TELA described as *re-u-ko-nu-ka*, etc., by workgroups whose names are not attested in the Lc(1) tablets (though this of course could simply be a matter of chance). One of these, Ld(1) 598, records the delivery by workers ‘of ’ one *wi-jo-qo-ta* of ‘plain’ TELA described as *po-ki-ro-nu-ka* , ‘with variegated *onukhes*’, *re-u-ko-nu-ka,* ‘with white *onukhes*’ and *ko-ro-ta2* (meaning unclear), all of them terms which are found in the Ld(1) ‘store’ records by the same scribe. It is difficult to believe that this is not some of the same cloth as we find on the ‘store’ records listed at the time of its delivery to the centre from a separate finishing workshop.

Though some work on decorating cloth was certainly carried out by women,[15, 16] it is tempting to conclude that at least some parts

of the finishing process were carried out by men. The records in Hand 103, all of which appear to be concerned with the textile industry, include a number dealing with men, who are listed either by name or as a group. A few might be male supervisors of all-female weaving groups: but all 200+ can hardly have had that occupation. On the other hand, we have no evidence for men on any of the Lc(1) cloth production records, or anywhere else on tablets by Scribe 103, where we can confidently identify them as weavers. As(1) 602, As(1) 605, for instance, list single or pairs of men (VIR) followed by units of 'plain' TELA; but there are no wool entries following the TELA entries, such as we would expect if this were a weaving 'target' record. The text of As(1) 602 reads as follows (Fig. 8.10).

Ld(1) 573 (116)
.a e-ru-ta-ṛa-pi
.b pa-we-a , / ke-se-nu-wi-ja , re-u-ko-nu-ka TELA^{3} 35 *158* 1^{15}

Fig. 8.9: Tablet from Knossos recording cloth in store that may have undergone a separate finishing process.

As(1) 602 + 650 + 1639 + *fr.* (103)
.1]VIR 1 TELA^{1} 1
.2]jo VIR 1 [ ] VIR 1 TELA^{1} 1 [
.3] , qe-ro a-ta-qe VIR 2 TELA^{1} 1 ka-nu-se-u , ta-to-qe VIR 2 TELA^{1} 1[
.4]da-ro , a-ka-sa-no[-qe]VIR 2 TELA^{1} 1[ ]pe-re-*82-ta , qo-wa-ke-se-u[-qe VIR 2 TELA^{1} 1
.5]to-so [ ]VIR 12 [TELA^{1}]1 [

Fig. 8.10: Tablet from Knossos recording adult male textile workers and cloth.

A possible solution to the problem is provided by evidence from an outside source. In his magnificent study of the textile industry in Mesopotamia in the Ur III period,[17] which was organised along very similar lines to the Mycenaean industry, H. Waetzoldt has noted that while women wove the cloth, male *aslag*, 'fullers', were responsible for the work of finishing the fabric, which included washing it, using a kind of soap made from a mixture of the *naga* plant, which when combined with water produced an alkaline solution or lye, and oil or fat. In addition to fulling, the *aslag* had duties involving wool, which Waetzoldt suggests included repairing

faults in the cloth and adding decoration to it.[18] Are the men on the cloth records at Knossos, whose numbers relative to those of the women appear to have been comparable with those of the Mesopotamian *aslag*, again fullers, whose finishing duties also involved decoration? Note that the term *ka-na-pe-u, knapheus*, 'fuller', is attested in Linear B, including on the Mycenae tablet Oe 119, where the term is juxtaposed with the description *a-ke-ti-ri*[*-ja*, '(female) decorator' (of cloth).

Two final questions about the central Cretan textile industry mainly recorded by Scribe 103 remain to be asked. First, what was the status of the men and women workers who are dealt with on these records?[19] And, second, to what uses was the cloth they wove and finished eventually put?

Though the precise status of the female workforce remains controversial, we certainly have evidence that they were at least partially dependent on the palace for their maintenance: there is evidence at both Knossos and Pylos that the women weavers and other female workers in the state textile industry received food rations from the palace for at least part of each year. There is also evidence at both sites which seems easier to explain on the assumption that at least some of these women were fully dependent on the centres, i.e., received rations all the year round. One group at Pylos, for instance, is described as *ra-wi-ja-ja*, which, while its interpretation cannot finally be confirmed, is attractively taken as a reference to prisoners of war, *lāwiaiai*. At Knossos, too, at least one record in Hand 103 (Ap 628) mentions *do-e-ra*, *do(h)elai*, who there is good reason to believe in this context, though almost certainly not in others on the tablets, are chattel slaves. On the other hand, this is a description which seems not to apply to the great majority of the women in the textile industry; and it would be unwise to exclude the possibility that at least some of these other women are not fully dependent, particularly since there is reason to believe that some women textile workers at Pylos–though they do not belong to the main body of weavers, etc., there–were supplied to the centre by way of a *corvée* system, which would naturally suggest that they only provided part-time service.

As regards the male workers in the industry, while it is again impossible to be certain of their status, the analogy of other male workers in state-controlled industries in Mycenaean kingdoms, such as the metal-workers at Pylos, who worked only part-time for the centres and part-time on the land, suggests that the same may well have been true of them.

Finally, as regard the uses to which the cloth produced in the industry is likely to have been put, we can be certain that (small?) quantities of TELA+ *TE* (equalling *te-pa* cloth) at Pylos were used for religious purposes,[20] and the same may have held good at Knossos. That apart, little is definite, but some of the epithets that are applied to fabric at Knossos give possible clues. First, the TELA +*TE* on Lc(1) 525, which deals with the output of the women of *Se-to-i-ja*, is described as *wa-naka-te-ra, wanakterai*, 'royal', which may mean that it was destined for use by the monarch or his court: though the term might only indicate cloth of a particularly high quality, as is evidently the case with some of the 'royal' cloth mentioned in Mesopotamian archives.[21] Again, the cloth on the Ld(1) 'store' records is regularly described as either *ke- se-nu-wi-ja* or *e-qe-si-ja.* [22] *Ke-se-nu-wi-ja, xenwia,* very probably refers to guest-gifts, and one possibility is that this is cloth intended for exchange with the outside world, either as trade proper in the guise of gift-exchange, a common phenomenon in the Aegean and Near East at the time of the tablets, or as gifts to visitors to the palace or neighbouring monarchs (which may have been intended to create a friendly atmosphere in which more commercial exchanges might then take place).[23] Alternatively, however, it might merely refer to cloth of guest-gift *type*. *E-qe-si-ja, hequesia*, similarly, may refer to cloth which is designed to be offered as gifts to the *e-qe-ta, hequetai*, 'Followers', significant figures in the state who appear to have had particularly close links with the palace. Once again, however, we cannot be certain that this is not cloth which is merely of Follower type, i.e., is not a fabric which was intended to be given to or worn by *e-qe-ta*, but one which for some reason was called after them.

Much of the remaining cloth mentioned on the Knossos tablets appears to have been produced in palace-controlled workshops by

the same methods as the cloth recorded by Scribe 103. This includes *pa-we-a* produced in the far west of Crete and mentioned on 'production target' records by Scribes 113 and 115,[24] and several other varieties of fabric not dealt with on tablets by Scribe 103, such as TELA + *PU*, TELA + *KU* and 'plain' TELA qualified as *to-mi-ka* (meaning obscure). These varieties have recently been the subject of an important study by Marie-Louise Nosch,[25] who has clearly shown that they are treated by the palace administration in a different fashion from TELA + *TE*, etc.: not only recorded by different scribes, but also filed separately in the palace archives.[26]

Besides the cloth produced in the 'state' workshops, however, we also have some evidence for fabric which was made, doubtless using a domestic mode of production, in subordinate settlements of the kingdom and supplied to the centre by way of the tax system.[27] The garment denoted by ideogram **146* is one of six commodities recorded on the Ma tablets at Pylos as supplied to the palace by all sixteen of the districts into which the kingdom was divided for taxation purposes; and there is clear evidence on one record at Knossos (Nc 5100) that **146* was acquired by the centre there by similar means. There is something to suggest that, at Knossos at least, decoration was added to * *146* in the palace-controlled finishing workshops;[28] there is no evidence, however, that it was ever woven in the centrally-controlled weaving establishments. Indeed, it is tempting to guess that it was because of the inadequacy of domestically-produced cloth like * *146* for some of the purposes for which the Mycenaean palaces needed textiles (gifts to visiting dignitaries or the like) that the highly specialised palace textile workgroups were established. (Generally in the ancient world, the purpose of craft specialisation of the type that we find in the Mycenaean 'state' textile industry was to improve the quality of the product, not its quantity.)[29] Certainly, needs of this kind seem to have led to the establishment of similar highly specialist textile workgroups in another society we mentioned earlier: the Inca kingdom of pre-Columbian South America. J.V. Murra has written as follows in his *Economic Organization of the Inka State*.[30]

> At some point in the history of the Inka state, the corvée production of cloth by the household became inadequate for state needs. Craft groups were then set

up or existing luxury, *cumbi*-cloth weavers were incorporated into the state machinery. According to Betanzos this happened in Pachacuti's time, while a much later chronicler like Salcamayhua credits king Topa. Cripples, dwarfs and hunch-backs of both sexes–people less likely to set up family-type units and engage in agriculture, frequently became very skilled weavers. By the time of the European invasion, the housewife still continued to clothe her family, but many of the garments filling the vast storehouses found in 1532 were woven and tailored by specialists.

These craftsmen belonged to two quite separate categories:

1) Male weavers, *cumbi camayoc*, who wove *cumbi*, the better cloth. They were full-time experts and worked to supply state needs. Their special status as craftsmen exempt from corvée is indicated by Santillán, who states they had no other obligations beyond deliveries of cloth.
2) The *aclla*, the nun-like girls, kept weaving in 'convents' all over the kingdom.

Notes

1 On the typology and workings of the Mycenaean economy, see, e.g., Killen 1985; 1994; on comparisons with the Near East, see further De Fidio 1992; Postgate 2001.

2 On the Pylos 'state' textile industry, and how it differs from that at Knossos, see Killen 1984. On the Pylian workforce, see further Chadwick 1988.

3 *askētriai*, or rather the masculine *askētēs*, which may also be attested in the tablets in the form *askētēr*, does continue in use, but with a different sense: not 'decorator (of textiles, etc.)' but 'one who practises (esp. an athlete)'; see Morpurgo Davies 1979, esp. 99–104.

4 On the textile industry of Roman Egypt, see Wipszycka 1965.

5 For what follows on the Knossos sheep tablets, see Killen 1964.

6 For what follows on the Knossos Lc(1), Od(1) and Le tablets, see Killen 1966; further Duhoux 1976, 76–81; Killen 1974.

7 The TELA (cloth) ideogram clearly represents a vertical, warp-weighted loom.

8 *A-po-te*, it will be recalled, was one of the three male deliverers of wool mentioned on Od 562.

9 The tablet is broken at the right after the *pe* TELA + *TE* entry, and we cannot confirm whether there was also an entry of unqualified (equalling normal) TELA + *TE* here.

10 For the suggestion that Lc(1) 536 totals cloth recorded on Lc(1) tablets other than those dealing with workgroups 'owned' by the so-called 'collectors', see Olivier 1967, 91. It may also not count the 'royal' TELA + *TE* listed on Lc(1) 525.

11 On tablets by Scribe 102, *di* is written in full as *di-da-ka-re*, which probably indicates 'at the teacher's' (*didaskalei*).

12 On *TA* and *DA*, see Killen 1983.

13 Only three of the nine unit strokes on Lc(1) 540 have survived, but their arrangement–one below the other–makes 9 an almost certain restoration.

14 For what follows on the Ld(1) 'store' and 'store delivery' tablets and on possible male finishing workers, see Killen 1979(a).

15 The ideogram **158* at the end of the tablet appears to denote the cloth or leather bag in which the bale of cloth listed was stored.

16 We hear, for instance, both of female *a-ze-ti-ri-ja, askētriai*, 'decorators', and of *o-nu-ke* woollen decoration on a tablet in Hand 103, M(1) 683, to which we shall be returning at the end of the paper.

17 Waetzoldt 1972. On the *aslag* and their working materials, see Chapter 4.

18 Waetzoldt 1972, 168.

19 For what follows on this topic, see Killen 1979(b); further Uchitel 1984; De Fidio 1987, 138; Chadwick 1988, 89–93.

20 See Un 6 *verso*.

21 Veenhof 1972, 192–193.

22 For what follows on these terms, see Killen 1985, 263–264; further Melena 1975, 45; Olivier 1996-97, 286–287.

23 On the gifts of textiles (*sûbultum*) sent by the king of Mari to neighbouring monarchs, evidently with this purpose in mind, see Durand 1983, 515.

24 On these records, and a possible source of the wool used to weave the cloth they record, see Killen 1976.

25 Nosch 1998.

26 Nosch 1998 has shown, too, that something similar appears to happen with TELA + *PU* at Pylos.

27 For what follows on **146* and its acquisition by the palaces, see Killen 1984, 61–63.

28 The tablet M(1) 683, mentioned earlier, records on line 1 wool qualified as *o-nu-ke* and female decorators of cloth (*a-ze-ti-ri-ja*), and on line 2 30 units of **146*. Though we cannot be certain that the two entries on the tablet are related, it is tempting to suppose that the wool on l.1 was intended for decorating the **146* on l.2. (Another record with a similar pattern is M(1) 559, also by Scribe 103.)

29 Cf. Finley 1973, 207 n. 25.

30 Murra 1980, 71–72.

9 Washing and Dyeing Installations of the Ancient Mediterranean: towards a Definition from Roman Times back to Minoan Crete

by Maria Emanuela Alberti

The present research aims at investigating the techniques and industrial equipment used during the washing and dyeing of textile fibers and textile products and, at the same time, concentrating upon the problem of recognizing a viable archaeological work space. An interpretation grid is proposed on the basis of the most generally acknowledged evidence (different Mediterranean sites from the Late Bronze Age to the Roman period), and then applied to the less known Minoan evidence.

Introduction

Until now, the aspects of textile production which have received most attention are the spinning and weaving operations, with their iconographic, stylistic, commercial, cultural and administrative implications. Other working phases, such as dyeing, washing, carding and combing, are less known. Some studies have been executed using Iron Age, Classical, Hellenistic and Roman Mediterranean evidence, but the situation for more ancient periods, and especially for the Bronze Age Aegean, remains unclear. The present research aims to investigate useful techniques and industrial equipment for such periods and, at the same time, to concentrate upon the problem of recognizing a viable archaeological work area.

Definition of a Working Area and Main Characteristics of Washing and Dyeing Installations

How might a working area be defined? Many studies have been written on this subject,[1] without finding a unique, simple answer. Whilst architectural features provide no good or unequivocal criteria for recognizing a working area, the presence of many other elements can be considered as a more reliable indicator: built-in facilities, raw materials, tools, debris, scraps, incomplete products, and finished products (if not in store/hoard). The tool kit ought to include any associated pottery, especially coarse-ware (cooking pots, basins, storage jars, *pithoi*). But 'none of the individual categories of objects will, of themselves, act as an infallible indicator. Combination improves the chances, but even this may leave one well short of appreciating what exactly happened where'.[2] Other useful insights could be provided by the techniques of contemporary traditional workers, and by the evidence of commonly accepted ancient workshops, '[…] thus presenting a realistic picture of what can be expected and what actually does survive'.[3] Plucking/shearing, washing, carding, and dyeing are unfortunately crafts whose implements could be largely or wholly perishable or simply mistaken for something else. Through the comparison with traditional and ancient techniques it is possible to outline the different working steps with their own tools.[4] In these pages, only the evidence related to probable washing and dyeing facilities will be discussed.

The archaeological indicators for washing and/or dyeing workshops have already been outlined.[5] We find in the list all the washing equipment (water supply, basins, vats, drains, a way of heating, drying areas), and the tools to prepare the dye-stuffs (pounders-grinders, etc.), plus a means of salvaging excess dye. The type, the structure and the dimension of each area all depend on the scale of the ancient operations. In any case, however, it is not possible to exclude the possibility that such spaces were multi-purpose.

In order to examine the archaeological evidence, and to be able to interpret the differences occurring between the different contexts, the associated materials can be divided into several

categories:

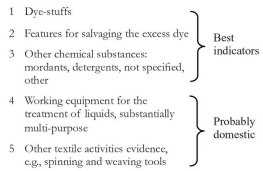


Fig. 9.1: Non-Bronze Age Aegean Ancient sites.

Towards a Model: Analyzing the Best-known Ancient Washing and Dyeing Contexts

Many ancient Mediterranean sites are generally accepted as probable, if not sure, examples of textile fiber processing structures. They date almost all to the 1st millennium BC, but there are also some cases dating to the late 2nd millennium BC. Their evidence is analyzed here in Fig. 9.1, using the criteria stated above. In this way, their characteristics are outlined and organized according to an interpretation grid, which could constitute a first 'model' for use on lesser known archaeological contexts. The sites can be therefore tentatively grouped as follows:

Group A–Sites with dye-stuffs and equipment for large-scale treatment of liquids.

Dating to the Roman period, they are specialized workshops (*officinae tinctoriae*): Pompeii, *offectoria* VII.ii.11 (Italy, 1st century AD); Barcelona (Spain, 2nd century BC); Athribis (Egypt, Roman period). To this group should perhaps be added the more ancient site of Nir David (Israel, 10th century BC), where dyeing was probably not the only activity carried out.

Group B–Sites with important equipment for large-scale treatment of liquids and, in most cases, with mordants and detergents.

They could be intended as fulleries or even dye-workshops (see the particular vats adapted to recover the excess dye at Tell Beit Mirsim). A Roman *fullonica* is–not surprisingly–included in this

group as well. The more ancient examples, however, should be regarded as multi-purpose working areas.6 The sites of this group are as follows: Tell Beit Mirsim (Israel, 8th–7th centuries BC); Rachi (Isthmia, Corinth, Greece, 4th–3rd centuries BC); Khorsiai (Khostia, Greece, Hellenistic period); Pompeii, *fullonica* VI.viii.20–22 (Italy, 1st century AD).

		A				B				C			
		Pompeii offect.	*Barcelona*	*Athribis*	*Nir David ?*	*Mirsim*	*Rachi*	*Korsiai*	*Pompeii full.*	*Enkomi*	*Lato*	*Pompeii*	*lanifr.*
1	dye-stuffs	x	x	x	?		?				?		
2	excess dye salvaging					x		?					
3	mordants – detergents		x			x	x		x				
	other chemical substances		x										
4	pounders-grinders, etc.						x				x		
	drying areas	x	x				x	x					x
	large vases (cooking pots, basins, chauldrons)	x			x	x	x			x	x		x
	vats and drains		x	x		x	x	x	x	x	x		x
	paved or plastered surfaces		x	x	x	x	x	x		x	x		
	cisterns, pits, wells	x		x		?	x	x	x		x		
	workbenches		x	x		x		x	x				x
	heating	x			x					x			x
5	Loom-weights, spindle-whorls				x	x	x	x		?			

Group C–Sites with medium- or small-scale equipment for treatment of liquids, without any indication of dye-stuffs or mordants.

They are very probably multi-purpose working areas, for various kinds of processing activities on a domestic or light working level. Washing, dyeing, fulling can obviously be contemplated–and indeed the general pattern is almost the same for a Roman *lanifricaria* (identified mainly on a epigraphical basis). The common domestic association with spindlewhorls and loom-weights does not point to a real textile specialization. The sites of this group are as follows: Enkomi, Area III, room 32 b, Level III A (Cyprus, 13th century BC); Lato (Crete, Greece, 5th–2nd centuries BC); Pompeii, *lanifricaria* VII.xii.17 (Italy, 1st century AD).

Exporting the Model: Looking for Washing and Dyeing Installations on Minoan Crete

For many areas of the ancient Mediterranean, especially for the pre- and proto-historic periods, such an analysis has not yet been carried out. For Crete, the only center that has been considered until now is the Early Minoan (EM) village of Myrtos Fournou Korifi, a good example of a washing/processing fiber area.7 Fig. 9.2 is an attempt to apply the interpretation grid to some Minoan sites. Other suitable

sites will probably be detected in the future. All of the work is conditioned strongly by the different quality and detail level of the field reports. For the moment, the sites can be tentatively grouped as follows:

Group A–Specialized sites with dye-stuffs and equipment for large-scale treatment of liquids.

Not found at Minoan sites.

Group B –Sites with important equipment for large-scale treatment of liquids and/or with evidence of chemical substances linked to textile fiber processing. They should probably be regarded as multi-purpose working places for various kinds of processing activities, including washing, dyeing and fulling. The latter operations are suggested from the strong evidence for other textile activities. In particular, the group can further be divided into:

Ba–EM multi-purpose working contexts with modest scale equipment for the treatment of liquids and chemical evidence of substances probably related to textile processing. The uncertain nature of those substances, the chronology and above all the small scale of the structures, however, speak against textile specialization. The considered contexts are two groups of rooms at the village of Myrtos-Fournou Korifi: rooms 16–17 and 58–60 (EM II).

Bb–Medium-scale working contexts with equipment for the treatment of liquids composed of one or more rows of independent, plastered vats of medium dimensions. The purpose of such structures is far from clear, but they seem unsuitable for wine and oil processing. Dyeing, though not demonstrable, is the only tentative solution that has been suggested. It is probable that jars and other containers were used as vats. The two considered contexts are as follows: Kato Zakros, Palace, rooms xvii–xx (LMI) and Hogarth's House J/I, room v (MMIII–LMI).

Bc–Medium-scale working contexts with equipment for the treatment of liquids composed by a wide range of different features. They are the best suited areas for processing liquids at a quite intensive level. The (not exclusive) connection with washing/dyeing is suggested by the strong evidence for other textile activities. The sites are: Myrtos Fournou Korifi, rooms 8–10 (EM II); Kato Zakros, Platon's House B,

rooms M/ N (LMI–LMIII) and Platon's House Δ, rooms Λ-Λ1 + Θ (LM III A2–B); Petras, House II (LMIB, preliminary data). To this group can perhaps be added the 'villa' at Epano Zakros (see below, group C).

Group C —Sites with medium or small-scale equipment for treatment of liquids, without any indication of dye-stuffs or mordants.

They are very probably multi-purpose working areas, for various kind of processing activities at the domestic or light working level. Washing, dyeing, fulling can obviously be contemplated. Myrtos Fournou Korifi, rooms 72–74 + 81 (EM II); Haghia Triada, Complesso della Mazza di Breccia (LMIB); Kato Zakros, Hogarth's House J–I, room xvi (MMIII–LMI), Hogarth's House A (MMIII–LMIIIA), Hogarth's House E (MMIIIB–LMIA), Platon's Houses A, room Λ (mainly LMI), Platon's Court Π, Platon's House E, room B (LMIB), Platon's House E (LMIB), Platon's House Z; Epano Zakros, 'villa', room A (LMI).[8]

| | | B | | |

Without chemical data, it seems therefore very difficult to detect such a working areas in pre- and proto-historic contexts, especially in Minoan Crete, where high-specialized industrial plants seem to be lacking, and the known workspaces are generally multi-purpose. The few cases of 'serial' installations are represented by the two rows of plastered vats at Kato Zakros (see Bb), but their interpretation remains obscure. At the same time, washing tools are quite common in every domestic or working context, pointing to an everyday (not specialized) activity. Unfortunately, very few and controversial chemical data are available for Minoan contexts. During the 1st millennium BC, however, the specialization of working organization increases at every level, leading to high-specialized plants in late Classical, Hellenistic and Roman times. The division of Roman *officinae* in *tinctoriae, fullonicae* and *lanifricariae* illustrates very well this phenomenon. The diffusion of such a model in all the Roman Mediterranean and the preservation of many good examples permit us to appreciate their archaeological differentiation and to afford a more confident final interpretation.

Acknowledgements
I wish to warmly thank my Ph.D. coordinator, Prof. Paola Càssola Guida, for allowing me to publish the first results of my Ph. D. research, and Prof. David Rupp for proof-reading the English text.

Notes

1 See especially Evely 1988; Tournavitou 1988; Kopaka-Platon 1993; Evely 2000.

2 Evely 2000, 550–551.

3 Tournavitou 1988, 459.

4 Barber 1991; Tzachili 1997.

5 See especially Barber 1991, 239–240 and Monaghan 2000.

6 Mirsim and Rachi have also been interpreted as olive presses, see Eitam 1990; Anderson-Stojanović 1994; Anderson-Stojanović 1998.

7 EM = Early Minoan (Ancient Bronze Age, c. 3700–2300 BC); MM = Middle Minoan (Middle Bronze Age, c. 2300/2200–1600 BC); LM = Late Minoan (Late Bronze Age, c. 1600–1050 BC).

8 With the completion of my Ph.D and the progress of my research, the present classification has been improved and modified in many ways.

10 The Kingdom of Midas and Royal Cloth Production

by Brendan Burke

From Central Anatolia, the legends of King Midas and his Phrygian kingdom centered at the site of Gordion are well known in Greek and Roman sources. In this paper I would like to move away from the legends of Midas and his phenomenal riches and instead concentrate on a likely source for Phrygian wealth and economic might: textile manufacture. This paper will demonstrate that a centrally organized textile industry was a major feature of the Phrygian royal economy at Gordion during Midas' reign.

Midas was an historical figure of the late 8th century BC ruling the land of Phrygia in central Anatolia. Midas was also a key figure in Greek and Roman legends, known most famously for his ass's ears, the Gordian knot, and his golden touch.[1] The most enduring legendary image of Midas is of a man of excessive wealth. The poet Tyrtaios (fr. 12, 6) in the mid-seventh century BC is the first Greek to use Midas as an example of wealth and Herodotus (I.14.35) tells us that he was the first non-Greek to make a dedication, his elaborately wrought throne, at Delphi. Aristophanes, Plato and Clement all cite the Phrygian king as the archetypal 'wealthy' man.

The home of Midas was Gordion, located by ancient authors on the Sakarya River plain equidistant from the Pontic and Cilician Seas (*Hist. Alex.* III.1.11). Gordion was first identified in 1900 by the Austrian Körte brothers (1904) in the Turkish village of

Yassıhöyük (Turkish for ‘flat mound’), about 80 kilometers southwest of Ankara and has been under investigation continuously since 1950 by the University Museum of the University of Pennsylvania. Around the modern village the landscape is dotted with Phrygian tumuli, dominated by the largest burial mound in Turkey, the so-called ‘Midas Mound’. The main area of major excavations is conventionally known as the Citadel Mound or City Mound (Fig. 10.1). Archaeological material from the citadel and from the great tumuli provide an almost ideal opportunity to study the organization of a well-developed textile industry and to discuss how this craft functioned in the political economy of 1st millennium Anatolia.

During the Hittite Old Kingdom period, Gordion may have been a part of the region of Arzawa which included such cities as Sallapa and Parduwata, recorded in Hittite documents along the Sehiriya River, probably the Sakarya.[2] Spindle-whorls and loom-weights from Bronze Age strata show that textile production had a long history at Gordion even before the arrival of the Phrygians. Gunter catalogues several Bronze Age spindle-whorls and Young mentions ‘many spindle-whorls’ from the Northwest Building which are prehistoric.[3] There were 21 unpublished whorls from the excavations by Voigt dating to the Late Bronze Age/Early Iron Age.

In the Iron Age, massive quantities of tools indicate a large-scale Phrygian textile industry in standardized workshop units, in the so-called Terrace Building and the Clay Cut structure (Fig. 10.2). This evidence is supported by fragments of well-preserved textiles from the tumuli and from the elite structures of the citadel. The quantity of tools suggests that textile manufacture exceeded the needs of any local Phrygian elite and that cloth functioned as a wealth finance good, which had some standard of value of use to the state, perhaps as a form of payment for services by administrators, soldiers, or other craft specialists.[4]

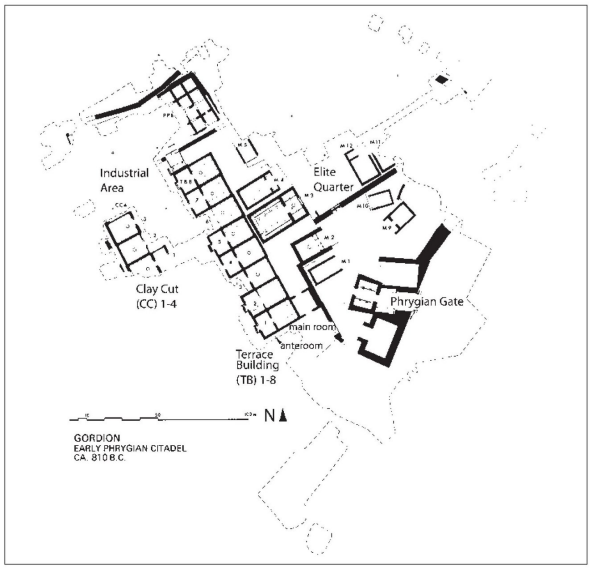


Fig. 10.1: Plan of Gordion. Early Phrygian Destruction level, ca. 810 BC. (plan courtesy of Gordion Archives, University of Pennsylvania Museum).

The first study of the textile fragments from Gordion was published by Bellinger (1967), who identified various types of fibers: linen, hemp, wool and mohair. Ellis (1982) analyzed the textiles in more detail with a binocular microscope. More recently, Mary Ballard prepared an unpublished preliminary report, noting that the condition of the Gordion textiles varied greatly.[5] Some are well preserved, fairly pliable and strong; others, however, are brittle and nearly disintegrated, which makes identification of their structure difficult if not impossible. Some samples are very brittle but have a fairly easily identifiable structure due to preservation in the proximity of copper alloys, turning them into pseudomorphs. Ballard reports that many of the fibers at Gordion appear to be wool or goat and are very fine, some with diameters falling into the range of cashmere, mohair, and merino, at 19–20 microns. In some examples, the epicuticle is abraded off so none of the characteristic scales of animal fibers is present. Sometimes crystalline material obscures the fiber structure or, in other cases, the fiber has collapsed. Of the bast fibers, Ballard reports that they are probably

flax, with diameters in the 10-micron range, comparable to Egyptian linen in fineness. She was unable to distinguish between hemp and linen under the microscope. Three different types of fabric structure are reported for textiles from Gordion: plain weave with variations, weft wrapping or 'Soumak', and felt.

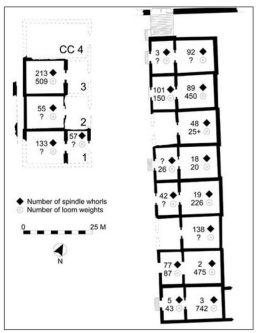
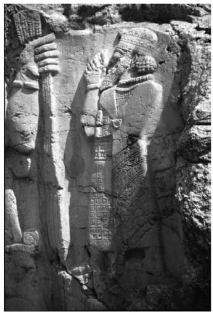


Fig. 10.2: Gordion Terrace Building and Clay Cut structure with distribution of loom-weights and spindle-whorls. (drawing–Burke and Albinger).

Fig. 10.3: Textile fragment from Megaron 3, Gordion. (photo–Burke)

Fig. 10.4: Relief sculpture of King Warpalawas of Tyana wearing Phrygian textile and fibula, Ivriz, Turkey. (photo–Burke)



Some of the textiles from Gordion (Fig. 10.3) imitate Phrygian motifs found in other works of art, including sculpture and mosaics. A Phrygian cloak and fibula is shown on a sculpted relief at Ivriz in central Anatolia (Fig. 10.4). The Neo-Hittite relief of King Warpalawas of Tyana, a contemporary of Midas, stands before a fertility god.[6] He is wearing what is probably an object of elite gift-exchange. His outer garment shows close parallels to pieces of textiles recovered from the citadel of Gordion and it has similarities in design to the patterns found on the wooden furniture from the Midas Mound. In the Citadel Mound itself, the monumental building Megaron 2 has yielded one of the earliest known pebble mosaics, which was laid in a variety of patterns, perhaps imitating Phrygian carpet designs. This mosaic provides a vivid image of the types of textiles that were produced at Gordion. Textiles found in Megaron 3 next door, for example, compare well with the designs on the mosaic. Meander patterns, lozenge designs and other tapestry weaves are found in the mosaic and on the textile fragments thought to belong to furniture in this elite building.

We can be reasonably assured that most, if not all, of the textile fragments found were made at Gordion. Evidence for concentrated weaving and spinning activity comes from the Terrace Building (TB) and the Clay Cut (CC) structure built on an extensive terrace approximately one metre high behind the back walls of Megarons 1–4 (Fig. 10.1). This terrace created restricted access between the elite quarter and the industrial sector, and could be entered only from the two ends.[7] Twelve individual megaron units (TB 1–8, CC 1–4) of identical form were excavated to varying degrees in these two buildings (Fig. 10.2). Each unit measured approximately 11.5 m wide and 20 m long, and had a single-stepped entrance leading

to an anteroom, often containing cooking installations, and a main room behind. Preserved in the sudden destruction fire of about 810 BC, textile equipment, food-processing installations, and large quantities of pottery were the primary finds from the workshops. Evidence for cloth production is plentiful, including clay spindle-whorls, loomweights, knives and other tools made of ivory, bone, and wood.

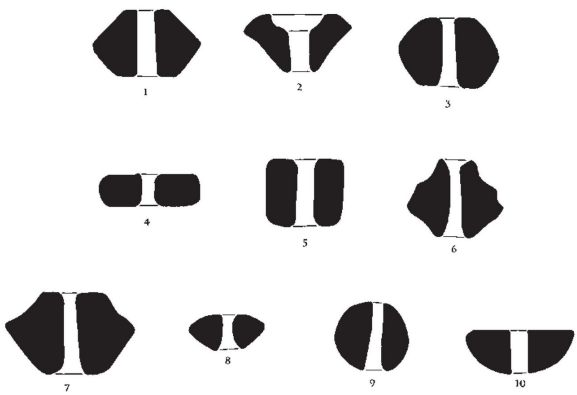


Fig. 10.5: Spindle-whorl types from Early Phrygian destruction level, Gordion, ca. 810 BC. (drawing–Burke and Lehmann)

Over one thousand fired clay spindlewhorls were recovered from the destruction level. Ten different types were distinguished based solely on the shape and profile of the whorls used to analyze variation, yet none of the whorls showed signs of distinctive decoration (Fig. 10.5). Most examples were Type 1, asymmetrical, biconical whorls with fairly smooth surfaces, and some had a mica slip. Even though many of the whorls were severely damaged by fire, some revealed traces of vegetable temper in a fairly standardized fabric. The whorls range in weight from very light, less than 10 g, to those heavy enough to have functioned as light loom-weights, about 100 g or more. The average whorl weighed twenty-four grams.

The most common type of loom-weight found at Gordion is referred to as the ‘doughnut’ type because of its round shape and large central hole. Other shapes occur at Gordion in nearly every occupation level but none in such large numbers as the Early

Phrygian ‘doughnut’. The weights were made of sun-dried clay from the banks of the Sakarya River and only preserved accidentally in the fire that destroyed the Citadel Mound. Only a small percentage of the recorded loom-weights from Gordion were available for study, as most had been discarded or had deteriorated in storage. At least 2750 of these ‘doughnut’-shaped loom-weights have been identified from the Gordion excavation notebooks. The most noteworthy aspect of these loom-weights is their large size–they average about 560 g, suggesting that the cloth produced in the workshop units was a fairly thick, heavy-duty textile, rather than fine or delicate fabrics.

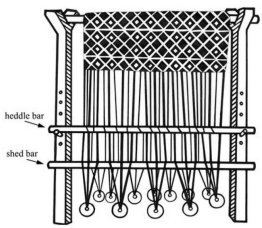


Fig. 10.6: Loom reconstruction, Gordion Terrace Building. (drawing–Burke and Hill)

The shape of the Gordion loom-weights suggests that warp threads were directly attached to the unfired clay weights, through the central hole (Fig. 10.6). Some sets of weights found in the Terrace Buildings were found in one or two rows, as if the loom was still standing at the time of destruction. In the anteroom of TB 7 three sets of weights were found in lines, one with 21 doughnut-shaped weighs about 1.59 m in length. This length gives us a good idea of the width of the textiles woven on this loom. Approximately 70 looms were located in the eleven main rooms and the seven anterooms at the time of destruction. If we reconstruct a complete CC structure with a total of eight rooms, like the parallel TB structure, and we include all of the unexcavated anterooms, that would make 32 rooms, which suggests at least 125 looms located in this industrial area. Of course, some of the weights found were in storage and perhaps we should not imagine all of the weights in use at the same time, but the number of possible looms suggests a great deal of weaving activity.

The main room and anteroom of Terrace Building 2 provide a good example for the type of textile production evidence from Gordion. The northern corner of the main room of this building was first uncovered in 1957 during the excavation of TB 3, the so-called 'Kitchen.'[8] About 100 loom-weights were found on the eastern side of the room, trench W1S, and about 25 were found in the south-eastern quarter, W2S.[9] Approximately 375 more loom-weights were found in other parts of this room, totaling over 500, according to Young's 1962 season report.[10] The weight in grams of the loom-weights is unfortunately not recorded and the weights themselves could not be found in the pottery depots at Gordion. As in the main room of TB 1, a few spindle-whorls are reported from this room. A flat bone implement from TB 2 may also be related to textile production if it was used as a weft bobbin. Weft thread would be wrapped around the body of the object and then gradually unwound as it was fed through the warp threads.[11]

The anteroom of TB 2 (TB 2A) was excavated in 1989 in the renewed excavations directed by Voigt.[12] The recent excavation and detailed record keeping of the finds from this room make it the best example for detailed analysis of textile equipment. A total of 87 typical doughnut-shaped, clay loom-weights were excavated and cataloged in 1989. The average weight for the loom-weights from TB 2A was 557 g, with sixty percent in the range of 400–700 g. The distribution of their weights shows that standardization or uniformity was not strictly adhered to although they fell within a general range.

One interesting aspect of the loom-weights was the change in the recorded weight over a short period of time for the same loom-weight. These unintentionally fired weights absorbed moisture while buried in the destruction level. Once excavated they began to dry out and consequently lose weight. Many of the thousands of reported loom-weights from the destruction level were discarded during Young's excavations in the 1950s because it was thought that they would not survive intact in storage. Based on studies of the recently excavated doughnuts from the 1989 season, this was a correct assumption. Since excavation, the poorly fired weights simply dried out and disintegrated into small mounds of clay and dust. The absorption and evaporation of moisture affected the measured weights to varying degrees. Many of the weights recorded

initially in 1989 had decreased dramatically in weight by 1996.

Along with the loom-weights in TB 2A, 77 spindle-whorls were found. This substantial number in the anteroom is slightly puzzling because of the scarcity of spindle-whorls in the other rooms of TB 1 and 2, suggesting that spinning was absent for the most part in the first two units of the Terrace Building. Of these whorls from TB 2A, the largest percentage weighed between 10 and 20 g, approximately 37%. The majority weighed less than 20 gr. This is less than the average weight of the whorls from all of the Terrace Building rooms (24 g). Some were found in groups or clusters, sometimes stored in ceramic vessels along with metal needles and knives. These whorls are particularly interesting because they may reflect the spinning kits of individual workers. The measured weights of these groups showed a fairly broad range. The Phrygian spinners seem to have used a variety of weighted whorls for different qualities of thread, as demonstrated by the variety of textile samples preserved at Gordion. One set of thirteen whorls ranged from three to thirty-eight grams.[13] All were of the same pink-orange fabric and weighed an average of 13 grams. Whorls of another set were found together in pot YH33668 and were made of the same fabric as the other whorls from this room.[14] The measured weights were fairly uniform, ranging only from ten to fourteen grams.

A carefully made comb was also found in the anteroom of TB 2. This heavily charred, long-toothed comb is certainly associated with textile production since it has unwoven warp threads adhering to one side and woven textile on the other. Its use with textiles suggests that it would have had a fairly smooth surface and was probably made out of wood.[15] The comb had a plain top and sides with a slightly curving row of teeth. It is very fragmentary but Barber has suggested to me that this tool is quite possibly the earliest known reed. This weaving implement would keep the warp threads separate and push the weft threads down all at once. This reed or comb may have been used on a warp-weighted loom or for bandweaving. The relatively small size of the object from Gordion, approximately 6 cm wide, suggests that it would be used for making small, decorated bands.

In addition to cloth production equipment, the Terrace Building and the Clay Cut structure provide a great deal of evidence for food preparation at Gordion. TB 7, for example, contained three stations

along its back wall. The main stand showed evidence for at least six people working. A mud-plastered bin was located on its western side, perhaps for holding ground grain. Nearby were piles of burned wheat and barley, some of which were contained in baskets. In the northeast corner, two additional stands were set up adjoining one another. Two more stations for grinding continued along the back wall, facing the same direction as the other six, while the adjoining segment held one grindstone and faced the eastern side wall. A large pit in front of these stations was found filled with burned debris but may have functioned as a storage area for unground grain.[16] One or two round dome ovens of brick and clay, a U-shaped construction of crude brick presumably for broiling and a round stuccoed hearth were the usual installations in the anterooms. The only exceptions were the anterooms of TB 1 and 2, which also lacked grinding facilities in the main rooms.

Side-spouted sieve jugs, known as beer mugs, had built-in tubes that would filter floating husks from the brew (Fig. 10.7). The lyric poet Archilochus, in a rather debauched simile, refers to the Phrygian custom of drinking beer through a long spouted jug and Xenophon also remarks on the straw-sipping Phrygians and their beer.[17]

The concentration of textile tools and food-processing equipment on a large scale within the Terrace and Clay Cut buildings, inside the fortification walls, indicates that large numbers of workers were active at Gordion to clothe and feed many people. The heavy-duty cloth that these weavers made would likely have been supplied to large groups of Phrygians, perhaps even the Phrygian military, which would have also depended on supplies of textiles, food and beer from the palace.

An instructive cross-cultural parallel for the pairing of cloth making and food production, including beer, is found at the Inca center of Huanuco Pampa.[18] Excavations within one part of this site revealed a large concentration of textile equipment and food processing. Unit 5 was built in a standardized architectural idiom, with secured and controlled access, similar to the Terrace Building and the Clay Cut structure. From 16th-century accounts, it is believed that this unit housed the *aqlla*, the chosen or, more accurately, 'abducted' women who became specialists of cloth manufacture and may have had a role in supplying food for military

personnel. The high density of liquid storage jars in Complex 5 also suggests that liquids were being prepared here, most probably *chicha*, corn beer.

Fig. 10.7: Side-spouted sieve jug, also known as a Phrygian 'beer mug.' (drawing from A. Körte and G. Körte, Gordion: Ergebnisse der Ausgrabung im Jahre 1900 JdI Ergänzungsheft 5, 1904).

At Gordion we lack administrative records similar to the documents we find in Aegean palaces, yet Phrygian textiles probably had a similar function to Aegean cloth, acting as both a medium of exchange and a prestige good. The large numbers of spindle-whorls and loom-weights of fairly similar shape and standardized size indicate cloth made on a massive scale, for distribution directed by the ruling elite. The large size of the doughnut-shaped loom-weight implies that the woven textiles were strong and durable. We can also reconstruct some aspects of specialization based on the distribution of some other tools, like the spindle-whorls. The function of this craft activity, what connects textiles to society, remains a topic for discussion. I can only merely suggest that this industry at Gordion was somehow connected to a Phrygian military since we lack textual sources that describe such a force. But Phrygian iconography and Near Eastern records suggest that the Early Iron Age was a fairly belligerent period in Central Anatolia. With these multidisciplinary approaches and careful analyses of all the tools of production, our understanding of Phrygian textiles and society can only improve.

Notes

1 Some ancient sources for these legends are Aristotle *Politics* 1.3.16 (=1257b16); Arrian (2.3); Plutarch (*Alex.* 18.1); Ovid, *Metamorphoses* 11.85–145. See also Drews 1983; Roller 1983 and 1984; J. Mallory 1982, 31; Burke 2002.

2 Garstang & Gurney 1959, 77–78; del Monte & Tischler 1978, 333, 544–45; Gunter 1991, 104.

3 Gunter 1991, Pls. 16 and 17, catalogue nos. 79 and 80 are Early Bronze. Middle Bronze Age whorls came from the sounding below Megaron 10, one spindle-whorl, catalogue no. 278, and one loom-weight, no. 334. From below Megaron 12, spindle-whorls nos. 471 and 492 also attest to Bronze Age textile production. See also Young 1966, 277–8. For a discussion of the Early and Middle Bronze Age spindle-whorl in its Eastern Mediterranean context, see Barber 1991, 299–310.

4 See Burke 1998 for textiles as a standard of value in the Bronze and Iron Ages. See D'Altroy & Earle 1985 for the use of textiles in a staple finance economy model. For textile arts in Asia Minor, see Bier 1995.

5 Pers. comm. Ballard has resumed study of the Gordion textiles recently and we look forward to her results.

6 See also Boehmer 1973; Mellink 1979.

7 See DeVries 1990 for the clearest exposition on the Early Phrygian architecture.

8 Gordion Excavation Notebook 46, 187–88.

9 Gordion Excavation Notebook 46, 75–76.

10 Young 1962, 165. Inexplicably, Young states that "the conventional name loomweights usually applied to (the doughnuts) is probably to be rejected out of hand."

11 Sheftel describes the object: 'Broken across at middle of sharp end; burnt white. Flat bone implement, probably pointed at missing end. Long head created by 5 small notches on each edge below a

rounded tip. Iron stain near one notch.' Sheftel 1974, inventory BI 427, L. 0.063; W 0.011; Th. 0.002.

12 Voigt 1994, 265–293, especially YHSS 6A on 272–3.

13 Catalogued as YH 33698, small find number 592, from locus 100, lot 211.

14 Catalogued as YH 33643, small find number 591, from locus 100, lot 211.

15 The comb is catalogued as YH33701, small find number 583, from locus 100, lot 211, 8/21/89.

16 Young 1966, 270.

17 Xenophon *Anabasis* IV. 5. 26. See also Sams 1977; 1993, 74–6.

18 See Murra & Morris 1976; Murra 1989.

11 Textile Production in Proto-historic Italy: from Specialists to Workshops

by Margarita Gleba

Textile production is often overlooked in the studies of ancient Italian economy since few actual textiles have survived in the Italian archaeological context. In this situation, implements associated with textile manufacture and the representational material provide additional evidence for the reconstruction of the economic and social role that the textile craft played in ancient Italian society. This paper examines how textile technology relates to such important concepts as urbanization, craft specialization, gender, trade, and agricultural and cultural development in Italy during the proto-historic period.

The period from the 10th through the 7th centuries BC in the Apennine peninsula is the time of development from small villages of mostly egalitarian type to large urban centers with social stratification and specialized crafts.[1] Organized production intensified significantly during these centuries, as did commercial exchange throughout and beyond the Italic sphere. Since textile manufacturing was practiced at all levels of society and was one of the most labor-intensive occupations, it was an industry of great cultural and economic importance, and must be factored into any balanced assessment of the ancient economy. Discussions of textile production, however, have been practically absent from all studies of the technology and economy of ancient Italy, no doubt because

of the extremely poor preservation of ancient fabrics. In contrast to other crafts, such as pottery production or metallurgy, neither raw materials nor textile products survive in the archaeological record of Italy, apart from exceptional cases. These surviving textiles, when examined together with contemporary representations and the implements used to make the textiles, provide evidence for the reconstruction of a craft that has been missing for the most part from the context of ancient Italian studies.

Unlike many other specialized crafts that appeared in Italy during this period, textile production was not new. Instead, part of that production shifted from the making of subsistence products to the manufacture of non-essential, luxury and surplus goods. As such, textiles present a special case in the development of the production system of ancient Italy. It is this specialized type of textile manufacture that I consider in this paper.

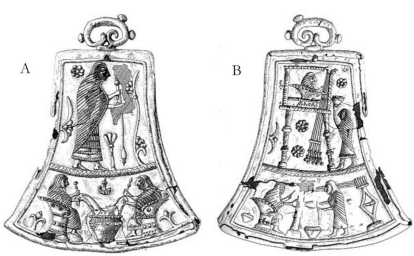
The Early Iron Age (950/925–730/725 BC) was a time of geo-political and social restructuring in Italy, resulting in the formation of proto-urban communities.[2] A rapid and growing socio-economic transformation followed during the second half of the 9th and the first quarter of the 8th centuries BC. As Pacciarelli notes, 'One of the motors of this change was the flourishing of trade and exchange fed both by these enormous proto-urban sites, which were natural places for "markets" and craft production, and by the dominant rank's demand for luxury goods,' including textiles.[3] The development of this uppermost social group reached its acme at the end of the Early Iron Age and is documented by the appearance of extremely rich burials.

Within these wealthy burials, one class of objects stands out as significant for the present discussion, namely, implements associated with textile production. Archaeological, representational and literary evidence indicate that in ancient Italy, spinning and weaving were practiced primarily by women.[4] Already at the end of the Bronze Age, the deposition of spindle-whorls, distaffs and the so-called spools (*rocchetti*) in female funerary assemblages testify to women's contribution to the community as textile workers, and indicate that the textile craft had become a symbol of the female sphere. During the Iron Age, finds of spindles and distaffs in precious materials such as bronze, silver, amber, and glass also support the notion that these implements were important markers

of elite female status. The tools themselves symbolized the prowess of the deceased woman in textile craft and, hence, her social role in the community,[5] while the precious materials of which they were made expressed her status as a wealthy and high-ranking member of that society. But the representational material, which is of great help to our understanding and reconstruction of this ancient technology, shows that there is still more complexity inherent in the symbolism/ tradition of cloth production.

One of the most important representations of textile production in the ancient world comes from Bologna in the form of a late 7th-century BC bronze *tintinnabulum* found in Tomb 5 of the Arsenale Militare necropolis (Fig. 11.1). It features four scenes depicting various stages of textile manufacture.[6] The bottom scene of side A illustrates two women seated in throne-like chairs dressing their distaffs for spinning. The top scene of side A shows a standing woman spinning. The bottom scene of side B most likely represents the weaving of the starting border necessary for the warp-weighted loom.[7] Such a loom appears in the last scene; moreover, it is two-storied and is the only such representation known from antiquity. Here, it is operated by a woman seated high up on a throne and assisted by another woman standing at ground level.

Fig. 11.1: Bronze tintinnabulum, Tomba degli Ori, Bologna, late 7th century BC (courtesy of Archivio del Museo Civico Archeologico di Bologna).



Another important object, also from northern Italy, is the wooden throne found in Tomb 89 at Verucchio. The shape of the cylindrical throne closely resembles the seats on the *tintinnabulum* and it has been convincingly argued by several scholars that these chairs are

indicative of the high status of their owners and users.[8] The throne, extraordinary for its state of preservation, has been dated to the end of the 8th/beginning of the 7th centuries BC.[9] The intricately carved scenes shown on the inner side of the back possibly illustrate the cycle of wool production, including wool washing, spinning, weaving and, finally, garment manufacture (Fig. 11.2).[10] The looms are quite high and operated by women seated on elaborate chairs (see also Fig. 17.13, this volume).

Both items are prestige objects in their own right, not only indicating that textiles constituted the source of wealth and/or status for their owners, but also illustrating that specialized textile production, specifically, the manufacture of ceremonial garments, was the prerogative of the elite women represented.[11]

So what were these textiles like?

As previously mentioned, a few actual textiles have survived in Italian archaeological contexts, and these are of the utmost importance for the information they provide. I will focus on two, arguably the most important finds of Iron Age textiles in Italy.[12]

The first comes from a 9th-century BC boat burial from the Caolino Necropolis at Sasso di Furbara, in central Latium; this burial has produced large quantities of cloth fragments analyzed and published by Masurel.[13] The textiles are of high quality both technically and aesthetically, and illustrate a wide range in terms of fineness and design. No complete piece has survived, but both garments and utilitarian textiles appear to be present. Some of the textiles are of extremely fine quality; the patterns represented are often obtained by varying the spin direction of the thread. An important piece is a fragment with a herringbone pattern made by using tablets. I will come back to the significance of this technique later.

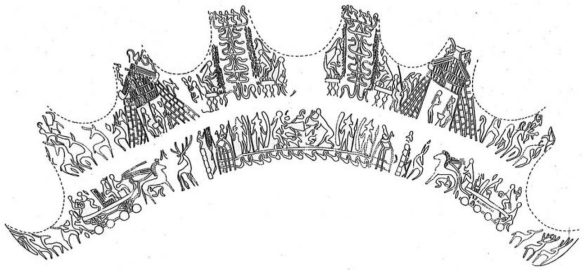


Fig. 11.2: Detail from wooden throne, Tomba del Trono (89), Rocca Malatestiana, Verucchio, 8th century BC (from Kossak 1999, Fig. 44).

Even more spectacular are the finds from Verucchio, which have changed our ideas about the technology of ancient Italian textiles. The site boasts the only surviving, practically complete Etruscan garments. Mantles and other pieces of clothing found folded, or displayed in the burials of Verucchio demonstrate that textiles constituted a very important part of a larger funerary ritual.[14] They reflected the status and identity of the deceased person and had social significance not only in life–there is evidence that these garments were worn–but also in death.

The recent publication of the textiles found in one of the tombs at Verucchio has given us the first glimpse of this sensational material.[15] The 8th-century BC Tomb 89, a wealthy cremation burial of an important male personage, includes not only the famous throne, but also over 160 fragments that were preserved by the cremation process, as well as two mantles and a kind of tunic, all of which survived almost intact. The mantles are of very fine wool, woven in 2/2 twill and colored brown and red, respectively. The pattern was obtained by varying the spin direction of the thread. The mantles measure at least 260 cm by 70 cm, and it appears that some standard dimensions were followed when weaving this garment type.[16] Annemarie Stauffer, who has analyzed these textiles, has suggested that the warp is the width of each mantle and thus, that the loom on which these mantles were produced must have been very high indeed. Thus, the looms depicted on the *tintinnabulum* and the wooden throne may be true-to-life renditions of actual looms observed in life. This conclusion would also mean that the mantles could be woven by one person,

thereby maintaining the exclusive nature of such work.

Among the numerous fragments preserved in the cremated remains, most of them twills with varied spin effect, there are some pieces that are very fine and dyed red or blue. One of the fragments is woven in a soumak technique, which, the investigator notes, is of a Near Eastern origin and therefore likely imported.[17] The future analysis and publication of other Verucchio textiles will no doubt shed more light on this intriguing discovery. For the moment, however, I would like to concentrate on another technique used in the textiles of Tomb 89.

Both mantles have elaborate borders featuring a triangle motif and three horizontal lines made by the tablet-weaving technique, in this case utilizing 36 tablets with four holes each along the perimeter.[18] The borders are dyed blue and purple for brown and red mantles respectively.[19] These tablet borders, probably added to the garment when the base textile was already finished, are extremely laborious and time consuming, making the technique very expensive,[20] and thus indicating that these mantles were a status symbol not only for those who wore them, but also for those who made them (see Figs. 17.11–12).[21] These textiles must have served as indicators of social rank or 'ceremonial' clothes,[22] with the border serving as the distinguishing element characterized by technique, pattern and color. Such borders are well illustrated in the later representational material, such as the Etruscan tomb paintings of Tarquinia and bronze figurines.[23] In fact, the *toga tebenna*, the Roman descendant of the Verucchio mantles, retained the border as the status symbol, in this case, dyed purple.[24]

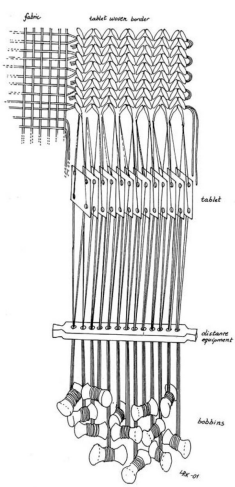
The scenes on the *tintinnabulum* and Verucchio throne thus demonstrate that only privileged persons were allowed to weave such garments, and it seems that this exclusivity was applied from the initial stages of preparation through the finishing.

If such indeed is the case, then the presence of textile implements in the Iron Age female burials, especially the so-called spools, highlights a new and crucial aspect of this industry. I have argued elsewhere that these spools were in fact used as small weights.[25] Lise Ræder Knudsen has demonstrated quite convincingly that they may have been utilized as weights for the sets of threads passing through the tablets used to make the borders on the Verucchio

textiles (Fig. 11.3).[26] Tombs containing spools and multiple spindle-whorls are few in comparison to those with just one spindle-whorl. Assuming that a greater number of such implements deposited with the deceased symbolizes that individual's skill in textile craft, we can see that such skill was far from common. Moreover, the vast majority of the burials containing spools were quite opulent, thereby implying that elite women possessed the exclusive right to use such tools in making special ceremonial garments with tablet-woven borders. One would expect to find the tablets as well, but because these were most likely made of wood or bone, they have not yet been identified in the archaeological record.

Spools appear in Italy by the Final Bronze Age. The fact that they appear earlier in the North seems to indicate that the technique arrived from Europe via the Alps. And, in fact, similar spools are common in Swiss Bronze Age contexts.[27] This is also paralleled in the frequent finds of tablet borders in Western and Central Europe.[28] The more significant finds come from the Kerameikos in Athens, Apremont, and Hochdorf, where a triangle motif similar to that of the Verucchio mantles has been noted, as well as Hohmichele, which has yielded a tablet border sewn onto a textile itself.[29]

Fig. 11.3: Tablet weaving of a garment border using spools and spacers (reproduced with permission of Lise Ræder Knudsen).



Although quite distant from each other geographically, the textile finds from Sasso di Furbara and Verucchio show many similarities, including the use of thread with varied spin direction to create a pattern and a tablet-weaving technique. They demonstrate that by the 8th century BC, a sophisticated technology existed in Italy, capable of producing highly complex and labor-consuming luxury textiles. Production of these textiles not only required very specialized materials and skills, available only to the members of the elite classes of society, but also was in itself an exclusive, elite, female occupation marked at death by the deposition of associated tools in the grave.

Despite the high degree of specialization characterizing this type of textile production in the Early Iron Age, it remained confined to the household level, as indicated by the regular finds of small quantities of textile instruments in settlement sites. By the 7th century BC, however, a new production mode seems to come into play, with the appearance of sites where enormous quantities of tools were concentrated in small areas or specific structures, such as at Murlo and Acquarossa.[30] The size, shape, material and often decoration of the tools themselves show increasing standardization, and they were most likely produced by specialists. What we seem to have now is something more akin to the workshop mode of production. This change coincides with the specialization and professionalization of other crafts, most notably metallurgy and ceramic production.[31]

By the mid-7th century BC, after a long period of development throughout the Early Iron Age, large proto-urban settlements emerged as centers of production and trade. Socio-political power became more and more concentrated in the hands of wealthy families who controlled both trade and production. Changes in economic demands led to ‘a gradual shift from production of luxury goods to subsistence goods and intensification of local specialized production,’ during the period between the 7th and 6th centuries BC.[32] The picture that we get from the funerary context is one of luxury textile production that is no longer controlled by the elites in the same way as in the Early Iron Age. Bronze distaffs common during the Villanovan period disappear by the 6th century BC as do the spools, which are found in tombs mainly dated from the 10th through 6th centuries BC, with a few exceptional cases dated 5th to

4th centuries BC. They continue to be found on settlement sites, but gradually disappear by the Roman period. The weaving of ceremonial textiles is no longer the prerogative of elite ladies, but is now handled by specialists or even slaves on a more 'industrialized' level.

Nothing of as high quality as the Verucchio textiles is known for later periods, although this might be–again–an accident of preservation. The purple border of the Roman *tebenna*, the likely descendant of the Verucchio mantles, was woven into the garment–a technique that was labor-intensive but nowhere near as extravagant as in the case of our Iron Age examples. It is tempting to posit an intermediate stage in garment evolution where the borders were tablet woven separately and sewn on the base textile, as in the case of the Hohmichele example.[33]

It is hard to tell at this point whether textile production was a household industry, was done in a workshop, or was part of estate production.[34] Probably, depending on time and place, it could have been any one of these or a combination of all three. It is also unclear whether textiles were made exclusively for household consumption or for trade as well. What the existing instruments do show is that we are dealing with surplus production by the 7th century BC. Trade seems to be indicated by the spread of fashion from what was now Etruscan Central Italy to the Northern areas. But as long as textiles constitute an archaeologically invisible trade item in Italy, any discussion of this topic remains conjectural.

Textile craft became specialized in Italy with the transformation of the social structure from an egalitarian to an aristocratic community. As in the preceding periods, women continued to make textiles at home, but only ladies of the highest rank possessed the right (and the skill) to weave the ceremonial garments. As the power of the military aristocracy declined, social and political power was transferred to the more mercantile element of society, and large urban centers developed that were able to afford specialists to produce not only luxury, but also subsistence goods. Textile production thus became an enterprise on a much larger scale, with archaeological evidence indicating that, with time, production moved from individual specialists in the early Iron Age to a specialized workshop-based manufacture during the Orientalizing and Archaic periods (mid-8th through 6th centuries

BC). It should come as no surprise that the urbanization of Central Italy should have been mirrored in a domestic environment in such an important craft as textile production.

Notes

1 Andersen 1997.

2 See Pacciarelli 2001, for chronology and discussion of the development of proto-urban settlements in Italy.

3 Pacciarelli 2001, 284.

4 Barber 1991, 283–298; Bartoloni 1989; Torelli 1997; Toms 1998; Nielsen 1998.

5 Bietti Sestieri 1979, 142.

6 Morigi Govi 1971; Kossack 1999, 67–68.

7 This interpretation has been put forward independently by Stage 1985, 56 and Barber 1991, 116.

8 For the symbolic significance of the cylindrical throne, see MacIntosh 1974, 21–24. See also Ræder Knudsen, this volume.

9 For the most recent analysis of the throne, see von Eles 2002, with revised chronology 273–275.

10 Gentili 1987; 2003, 28; Kossack 1995; 1999, 64–68; Torelli 1997, 63–86; for the latest interpretation, see von Eles 2002, 268–272.

11 von Eles 2002, 265.

12 Other recent discoveries have also added significantly to our knowledge about the textiles of ancient Italy. Articles of clothing found frozen at Vedretta di Ries in the Aurine Alps may provide yet another link with Central Europe, Dal Ri 1995–96. Textiles from the Orientalizing cemetery at Casale Marittimo include woolen and linen pieces of clothing and utilitarian fabrics, used for ritual wrapping of objects, Esposito 1999, 93–94. Textile fragments found

at various times in the Veneto region have been recently published by Maspero 1998, also adding to the corpus of the studied material. Textile fragments or pseudomorphs are frequently mentioned in excavation reports as remains of the wrapping material for various objects. Unfortunately, very few of these have been analyzed scientifically and the identification is often based on general observation or assumption. Further research should include a more systematic examination of Etruscan bronze and iron objects for traces of fabric, which can provide much information on the textiles of the period, as demonstrated by L. Bender Jørgensen 1992, for the North European textiles. For short summaries of extant ancient Italian textile fragments, see Bonfante 1975; Stage 1991; Barber 1991, 194–195, 174–175; Rast-Eicher 1997b, 545–553; and Gleba 2003.

13 Masurel 1977–82; Mamez & Masurel 1992.

14 Gentili 2003, 16–18, 31, 47, 54, 85, 89, 92, 96, 111, 113, 116, 118–119, 122.

15 Stauffer 2002 and Ræder Knudsen 2002. Other textiles from other Verucchio tombs are currently being studied by Stauffer.

16 Stauffer 2002, 197; von Eles 2001, 265–266.

17 Stauffer 2002, 213.

18 Ræder Knudsen 2002, 222–225. One of the fragments of the third garment found in the burial had a tablet-woven border of a simpler kind, obtained using 13 tablets.

19 Color analyses was performed by Jan Wauters; see von Eles 2002, 220.

20 Stauffer 2002, 208. Time spent on production, however, does not necessarily translate into monetary value; see Ciszuk, this volume.

21 Stauffer 2002, 212.

22 Stauffer 2002, 194, 208.

23 Borders were a typical element of Etruscan clothing: see Bonfante 1975, 15.

24 Bonfante 1975, 15, 39, 45, 48–55, 102; Granger-Taylor 1982.

25 Gleba 1999; 2000, 79.

26 Ræder Knudsen 2002, 228–229.

27 See, for example, Nagy 1999. The earliest examples, dated c. 1600 BC, come from Lake Zürich, personal communication from Kurt Altolfer.

28 Bender Jørgensen 1992, 123; Ræder Knudsen 2002, 232. This connection with Central Europe is not surprising. Already in the Early Bronze Age, the Italian textile technology demonstrated many similarities with the Neolithic Swiss material. See Barber 1991; Rast Eicher 1997a.

29 Banck Burgess 1999, 80–82; Ræder Knudsen 2002, 233–234.

30 See Gleba 1999, Gleba 2000 for Murlo, and Wikander 1986 for Acquarossa.

31 See Nijboer 1998.

32 Nijboer 1997, 400.

33 Banck Burgess 1999.

34 As defined by Peacock 1982, 8–10.

12 Textiles from the 1st Century CE in Jerusalem–a Preliminary Report

by Orit Shamir

Although the grave in the Ben Hinnom Valley had been robbed, there was a single, sealed loculus. Upon opening this grave, a black mass of material and some assorted bone fragments were found. The mass itself appeared to be made up of fabric and human hair. The bones in this loculus had not been gathered for a secondary burial, as was the custom for Jewish burials at the beginning of the 1st millennium CE. The textile fragments probably belong to a shroud. The deceased was buried with the shroud because it was not intended to remove his bones for secondary burial. Textile fragments belong to two or more items. They are made of wool and linen. The Z-spin of the wool suggests production probably outside of Israel and has formed only a small proportion of the textiles recovered in Israel and the neighboring countries in the Roman period. The wool textile from the Ben Hinnom Valley could, therefore, have been imported from Greece or Italy where the Z-spin was the norm.

Introduction–the Akeldama Area

The confluence of the Kidron and Ben Hinnom Valleys south of the Old City of Jerusalem contains one of Jerusalem's richest concentrations of rock-hewn tombs. This area, located on the periphery of the village of Silwan, was one of the main burial grounds during the Second Temple period, 470 BCE till 70 CE.[1]

The caves and chambers represent Jewish burial customs during the Second Temple period, and they will help us to determine the use of the textile fragments that were discovered in this area.

The burial caves had been carefully carved in the hard limestone

formations. Each of the tombs comprises a main chamber with *loculi*, with the occasional entrance chamber. Thick rock walls usually separated the chambers, with only small openings connecting them. The burial customs included a primary burial in *loculi* and a secondary bone collection in ossuaries. It seems that this custom had been introduced late in the Second Temple period, probably around the mid-1st century CE.

During November 1998 a burial complex in the Ben Hinnom Valley was examined, after it had been breached and plundered by antiquities thieves.[2] In front of the complex a rectangular courtyard extends with the entrance in its vertical, rock-cut, southern wall. The complex contains two burial chambers hewn at two levels. Steps lead from the entrance into a square burial chamber, No. A, with nine *loculi*, *kokhim* in Hebrew. A doorway in the northern wall of the upper burial chamber, east of the main entrance, leads into the lower chamber, No. B. Six *kokhim* were hewn in the walls. Twenty-eight of the ossuaries were found, decorated with rosettes and geometric patterns but without any inscriptions. Human bones were scattered all over. Though no finds such as coins and pottery or glass vessels were recovered at this tomb, the plan of the complex suggests a 1st century CE date.

Reconstruction

Although the grave at the Ben Hinnom Valley in Jerusalem had been robbed, a single, closed *loculus* was found by the archaeologists. Upon opening this grave, a nondescript black mass of material was found as well as some assorted bone fragments. The mass itself appeared to be made from fabric and human hair (Fig. 12.1). ^{14}C analysis carried out at the University of Arizona showed that the fibers dated to the 1st century CE. This immediately suggested to the media some comparisons with the Shroud of Turin.

Fig. 12.1: Jerusalem, Akeldama, human hair covered with wool textile, 16 by 16 cm. (Photographer: Clara Amit; Courtesy Israel Antiquities Authority)

This *loculus* was sealed and the bones had not been gathered for secondary burial as was the custom for Jewish burials at the beginning of the first millennium AD. In addition to being sealed, a crack above the *loculus* was probably responsible for the relative dryness of the site. Since this funneled off the water, it was probably a major determinant in preserving the site.

Multi-disciplinary Research

This research is multi-disciplinary, entailing collaboration between many scholars in the areas of archaeology and the study of burial practices, forensic analysis of textiles, hair and soil, and medical science with DNA analysis of bone and anthropological material.

The Deceased

The deceased was found to be male and has an mtDNA type that did not match any of the four other individuals in the tomb. He suffered from leprosy and tuberculosis. Leprosy, on its own, does not kill, but it does cause immuno-suppression that allows opportunistic organisms, of which tuberculosis is a prime example, to kill the individual. Leprosy and the fear and revulsion it created seem to provide an explanation for the sealing and isolation of the *loculus*.[3]

The Hair

His hair was brown in color and appeared very clean and may have been washed in close proximity to death. No insects, head lice, or lice cases were observed. There were a few cuts on the distal ends of the hair shafts, which may indicate that his hair was cut shortly before death.[4]

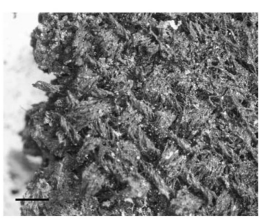
The Textiles

The textiles are carbonized. Insects probably caused the few holes (less than 0.5 cm by 0.5 cm). The textiles were also damaged by the relative humidity of Jerusalem and by body fluids. Because they were arranged in layers and stuck together, it was impossible to separate them without causing damage.

The *loculus* extended for 1.6 m. Some parts of the body[5] were covered with a number of textile layers. One layer of textile, the largest piece (16 cm by 16 cm), adhered to the hair that apparently surrounded it.

The textiles are made of wool and linen in plain-weave technique. The warp of the wool is Z-spun medium tightness (Fig. 12.2). The weft is almost unspun (I-spun) and thicker than the warp. The linen is S-spun. The number of wool threads per cm in the wool is 19 in the warp and 16 in the weft, with some remains of the closing cord, indicating the edge of the textile. The linen has 14 threads per cm in the warp and 9 in the weft, also with remains of the closing cord.

Fig. 12.2: Jerusalem, Akeldama, wool, Z-spun, x16. (Photographer: Kim Vernon. Research conducted at the Kuvin Centre for Infectious Diseases, Hadassah Medical School, Ein Kerem, Hebrew University.)



Microscopic examination of the wool exhibited no (double refraction) in polarized light, indicating that its organic material had decomposed.

Summary and Conclusions

The research is only in its first stages, but we can present our initial findings:

Edges: A closing cord is very common on wool textiles of the Roman period[6] and also appears on linen textiles. It is S-twisted or Z-twisted. It was found at 'En Rahel,[7] Mo'a, Masada, Murabba'at,[8] the Cave of Letters, Quseir al-Qadim,[9] Nubia,[10] Dura-Europos and Palmyra.

Linen shrouds have been discovered in Israeli burial sites. Wool was usually used for shrouds in secondary use. Preparing a corpse for burial consisted mainly of washing it and wrapping it in a shroud,[11] which was a garment specially prepared, or freshly laundered, for the purpose of wrapping the dead. The Hebrew word for these burial garments, *takhrkhin,* connotes wrapping and binding rather than dressing, as is indicated also by tractate Semahot: 'Man may wrap and bind men but not women, but women may wrap and bind both men and women.'[12]

Jesus' body was wrapped in clean linen cloth.[13] The author of John agrees that spices were used, but thinks that they were wrapped in the linen cloths, 'according to the burial custom of the Jews.'[14] Some more information on the use of shrouds can be found in John:[15] 'The dead man came out, his hands and feet bound with bandages, and his face wrapped with a cloth.'[16]

Sometimes shrouds were made from reused textiles. It is assumed that most of the tunics in the Cave of Letters had been ripped apart for use as shrouds. The sacks at the time of their discovery were in use as shrouds.[17] At the 1st century CE Khirbet Qazone cemetery in Jordan, some of the deceased still had the reused textiles wrapped around them.[18] At Dura-Europos a covering or a curtain was in secondary use as a wrapping for the deceased. [19] At Palmyra, the dead were first wrapped in several layers of simple cloth in secondary use, usually of linen, and finally with some sort of outer decoration. Sumptuous garments were cut into strips and arranged in a decorative manner on the wrapped bodies for this purpose. This habit explains why most of the textiles found at Palmyra are preserved in strips of different size.[20] Pfister remarks that these fabrics were not manufactured for sepulchral purposes, but as ordinary materials, used earlier, then cut up to wrap the corpse.[21] In Nubia, burial cloths, often made of several pieces of cloth which were sewn together to produce a sufficient length and width to

envelop the body, indicating that the cloths were not specially woven for funerary purposes.[22] Shrouds from the Roman period were found also at ‘En Gedi, Gesher Haziv, and Jericho, and imprints of textiles were found on bones and skulls.[23] The material used was probably linen because of the equal number of threads in the warp and the weft. Shrouds were found at Nahal David and Se’elim but the material was not specified.[24]

Origin: Wool textiles from the Roman period in Israel are usually S-spun. Z-spun textiles comprise only a small proportion of Roman-period textiles recovered in Israel and neighboring countries, while in Greece and Italy, the Z-spin was the norm.[25] Therefore the wool textile from the Akeldama tomb could have been imported. This would indicate that the individual came from a wealthy family. Importing a special and ‘fine’ burial cloth would entail time and expense, and would not have been done for the common man.

Several ossuaries (1st century CE) in the nearby tombs of Akeldama were inscribed with Greek names.[26] The glass vessels also show connections with Greece.[27]

Linens may well have been local Galilean, Beth She’an or Jordan Valley production.[28] Ancient textiles have not been preserved in Jerusalem because of the humidity. The detailed characterization of the weave has allowed them to be compared to the Shroud of Turin, an important relic of the Catholic Church, providing additional proof that the latter is not authentic. The Turin shroud is made of linen in a 3/1 herringbone twill pattern, Z-spun.[29]

Our finds illustrate the Jewish burial practices of Jerusalem during the 1st century CE.

Acknowledgements
I thank the organizers of the conference for their invitation which reached me during my struggle against my breast cancer and encouraged me to overcome the difficulties. I also thank the Hebrew University of Jerusalem and the Israel Antiquities Authority for the grant they gave me for this journey. Photos by Clara Amit. Most of these tombs were excavated in 1989 under the auspices of the Israel Antiquities Authority, under the direction of Dr. Gideon

Avni and Zvi Greenhut.

Notes

1 Avni & Greenhut 1996.

2 The cave was documented under the auspices of the Israel Antiquities Authority by Dr. Boaz Zissu, Dr. Simeon Gibson and Prof. Jacob Tavor. Zissu, Gibson & Tavor 2000.

3 The deceased was examined by Prof. M. Spigelman, Dr. Z. Greenblat and Dr. A. Gorski from ‘En Karem Hospital University.

4 A. Gorski, pers. comm.

5 DNA analysis by C. Matheson and K. Vernon. Vernon also examined the material of the textiles.

6 Sheffer & Granger-Taylor 1994, 181.

7 Shamir 1999, 94.

8 Crowfoot & Crowfoot 1961, 57.

9 Eastwood 1982, 286.

10 Bergman 1975.

11 Mishnah Kilaim 9, 4; Maasey Sheni 5, 12; Tosefta Nedarim 2, 7; Safrai 1976, 776.

12 Mishnah Semahoth 8, 7; Safrai 1976, 777.

13 Mark 15:46.

14 John 19:39.

15 John 11:44.

16 See also Safrai 1976, 776; Bar-Adon 1971, 22; Sheffer 1994.

17 Yadin 1963, 204–205, 218, 237.

18 Granger-Taylor 2000; Shanks 1999.

19 Pfister & Bellinger 1945, 34, No.116.

20 Schmidt-Colinet 1995.

21 Pfister 1934, 14; Taha 1982, 118.

22 Bergman 1975, 9.

23 Hachlili & Killebrew 1999, 169.

24 Aharoni 1961, 19; Avigad 1962, 182–183.

25 Sheffer & Granger-Taylor 1994, 236–237.

26 Avni & Greenhut 1996, 18.

27 Winter 1996, 96.

28 Midrash Rabbah, Genesis 19:1; Babylonian Talmud, Mo'ed Qatan 18b; Safrai 1994, 155–157.

29 Bortin 1980, 110.

13 Artifacts Related to Preparation of Wool and Textile Processing Found Inside the Terrace Houses of Ephesus, Turkey

by Elisabeth Trinkl

The excavations of the two Terrace Houses of Ephesus, Turkey, revealed a large amount of new information on the living conditions of the upper classes in Western Asia Minor during Roman Imperial times. Apart from the excellent state of preservation of the ruins, large amounts of material were recovered that provided an insight into social interactions. In addition to ubiquitous ceramics, glassware and coins, assorted furniture, and finds of bronze and stone, some artifacts related to preparation of wool and textile processing were uncovered. Spindle-whorls and distaffs were recovered–unfortunately, as of yet, we could not identify a spindle–as well as loom-weights and sewing needles.

Relatively little development of tools related to textile processing is seen in Roman times due to the inherent necessities of practical use. The discovery of textile-related tools in specific rooms of the Terrace Houses inevitably leads to their purpose. What information related to a model of social interaction within these residences may be derived from this identification? A small collection of similar objects within the whole ensemble of tools that are related to textile processing seems particularly interesting. When comparing their shapes, they closely resemble distaffs. However, none shows signs of wear. These findings unquestionably lead to a symbolic meaning of these objects within the social context of the women living and working in the Terrace Houses.

Since 1960, two civic domestic complexes, known as 'Hanghäuser', or Terrace House 1 and 2, have been systematically and completely excavated. Each insula was composed of multi-storied, individual residential units, each with its own inner courtyard. Both complexes were originally built in late Hellenistic / early Imperial times.[1] Apart from the excellent state of preservation of the ruins, such as the well-preserved mosaics and frescoes, large amounts of material were recovered, as of yet mostly unpublished, which provide an insight into social interactions. Aside from ubiquitous ceramics, glassware and coins, varied furniture, and finds of bronze and stone were uncovered.[2]

This paper will focus on an ensemble of artifacts used for wool and textile processing found in the Terrace Houses. Unfortunately, we found no preserved textiles and so far, no hoard has been uncovered, only individual items. This may not be the time and place for a detailed discussion of the shape and functionality of these kinds of artifacts. I will, therefore, focus on the presentation of the objects themselves, especially those that are not confirmed in other places beyond the vicinity of Ephesus.[3]

In the first section, I shall present a selection of the finds from the Terrace Houses and discuss distinctive features and functions of these artifacts, based on my personal observations. These finds prove that weaving, spinning and sewing were not uncommon in the prosperous Terrace Houses, albeit on a small scale. A small group of objects that resemble distaffs will be discussed in the second part of this paper. However, none of these shows any trace of practical use. This may indicate a purely symbolic meaning for these objects.

Weaving

Due to the continuous use of these buildings from the Late Hellenistic period to the beginning of the 7th century AD,[4] most of the finds date from the Roman period, as opposed to the Hellenistic one. Among the objects used in textile production, the most significant object is the lentoid loom-weight with two suspension holes (Fig. 13.1). The majority of the weights fall within a middle

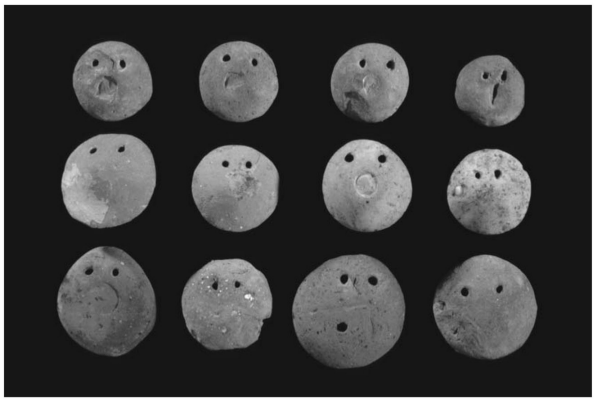
range of 50–65 g, while none is heavier than 100 g. The average diameter is c. 50 mm. It seems that in Ephesus a smaller number of weights are stamped as compared to other places.[5] Most of them are stray finds in later stratigraphical contexts. We know about only one ensemble of 2nd-century BC lentoid loom-weights that was uncovered in layers in the southern part of Terrace House 2 in 2001.[6] Some lentoid loom-weights from other sites are known, such as Miletus, Troy and Athens.[7] In this paper, the number of parallels is reduced to a minimum so we could concentrate on the topographical aspects.

More characteristic for Roman times are loom-weights of pyramidal shape, typically with one suspension hole (Fig. 13.2), rarely two.[8] The proportions are also somewhat more individual than that of the lentoid loom-weights. They are flat or rounded on the top, and the base is a square or a rectangular shape. Most are considerably heavier than their Hellenistic counterparts, some weighing more than 500 g. We also know two-holed, but older, parallels from Miletus. Some other one-holed loomweights in Knossos and Tarsus are bigger and cruder than these examples from Ephesus.[9]

A rare type is the conical loom-weight with two holes.[10] Some doughnut-shaped clay objects of different size could possibly also be interpreted as loom-weights.[11] But irrespective of their shape, all loom-weights are made of burned clay. Although there is no consistency in clay and inclusions, the clay of the lentoid loom-weights is, for the most part, more refined. In any case, their presence proves the use of warp-weighted looms until Imperial times.[12]

The surface of some pyramidal examples is decorated, but none is stamped to the extent of the lentoid loom-weights. Four of our samples are marked by an incised cross, three of them on the top, and one on its bottom face. One possible interpretation of these decorative stamps with respect to textile processes beyond their mere aesthetic value is as a mark of ownership. Considering the existence of a loom-weight with the graffito EP imprinted at the top (Fig. 13.3), interpreting the cross as a mark of ownership seems even more plausible.[13]

Fig. 13.1: Selection of lentoid loom-weights, Terrace Houses, Ephesus.



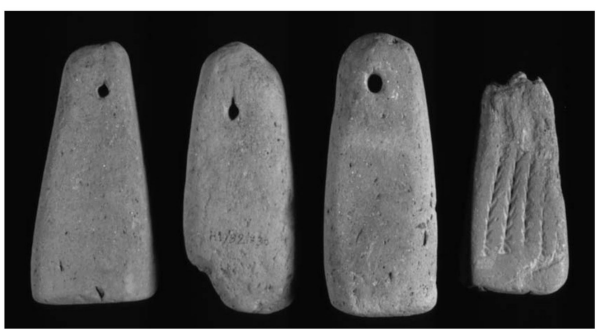


Fig. 13.2: Set of four pyramidal loom-weights, Terrace House 1, Ephesus.

Some weights of pyramidal shape are made of lead.[14] They have either one or two suspension holes. Similar to many of the clay loom-weights, the lead weights show typical wearmarks: a vertical cut is typically found above the suspension hole. It indicates function and extensive use. This cut may be related to other causes, but it is most likely attributable to a suspending thread. Sets of loom-weights made of lead, found *in situ* in Pompeii, indicate that loom-weights made of relatively expensive material may not be uncommon.[15]

The discovery of four pyramidal loomweights points to the existence of a functional group (Fig. 13.2). They were found in a

small room in Terrace House 1. Because of the architectural structure and of some additional finds, this area may have been a storeroom during the first half of the first century AD where the unused loom-weights were stowed.[16] Assuming the existence of a complete group, only four loom-weights seem like a relatively small amount for a vertical loom.[17] But, a group of four loom-weights appears several times in *in situ* complexes in Pompeii. R. Ling, therefore, proposes the existence of a smaller, frequently used loom, which only requires a total of four loom-weights, in the Campanian cities.[18] Our set could therefore be an eastern parallel.

Fig. 13.3: Pyramidal loom-weight with imprinted EP on top, Terrace House 1, Ephesus.

Sewing and Spinning

In addition to weaving, there is every indication that sewing and spinning were done in the Terrace Houses. A small number of sewing needles, mostly made of bone, have been found so far. They have one to three holes, varying in shape: round, oval or figure-eight shaped. Although the shafts often look polished, we are convinced, at least in our case, that the primary function is that of a sewing needle (Fig. 13.4). One net needle made of bronze has been found in Terrace House 2 as well.

No spindles have survived and even spindlewhorls are rarely found. They are made of a variety of materials, clay, glass, bone or stone, and are of varying heights, but all are of similar shape, resembling a spherical segment. For the first time a spinning hook was recovered in Ephesus (Fig. 13.5). It is made of a sheet of bronze, shaped like a spout, and topped by a hook.[19] The object itself gives no clue to its age, as the shape is dictated by functional criteria. From its stratigraphical context, however, we may establish

a production date in the first or second third of the third century.[20] Comparable spindle hooks are known from the Archaic to the Byzantine periods, e.g., at Sardes.[21]

Fig. 13.4: Selection of representative types of sewing needles, Terrace Houses, Ephesus.

Fig. 13.5: Spindle hook, Terrace House 2, Ephesus.

Outstanding so far is the following object, which was found somewhat further north, outside of Terrace House 2, but which is most likely part of the debris of the Houses: a small tablet[22] of bone with two holes which is decorated with two figures of concentric circles with a dot in the center. Although rectangular in shape, its use as part of a set of weaving tablet seems likely, but has not been confirmed definitely as of yet (Fig. 13.6).[23]

As most of the samples were found only in small numbers or even just as single objects,[24] professional textile processing may not have been established in the Terrace Houses. All these tools were essentially employed for ordinary, strictly non-professional, textile work. But who used them? Is it possible to build a bridge from the tools to the people who lived in the Terrace Houses?

Fig. 13.6: Decorated tablet, Streets of Curetes, Ephesus.

Bridging Archaeological Finds and Social Life

In Asia Minor we are just beginning to interpret social developments based on archaeological finds. In this regard the situation is entirely different from other parts of the Roman Empire. Based upon a small group of artifacts that took their shape from textile tools–but may not necessarily have been involved in textile production, I should like to bridge the gap from archaeological finds to Roman social life. A certain type of distaff, called "Fingerkunkel" in German,[25] served definitely as a model. These objects are short sticks with one looped end. As ensembles of spindle, spindle-whorl and distaff resemble each other in many locations in the Roman Empire, we are aware of the name and function of these tools. Nonetheless, these artifacts have often been misinterpreted. They were found on excavations, mostly associated with burials,[26] and they are depicted on gravestones, particularly in some regions of Asia Minor.[27] In this context, the spinning set does not give any hint as to the profession of the deceased. Rather, it indicates the social role that the deceased played during her lifetime. The woman controlled those people who did the spinning: she supervised all activities of the household, she was a domina, or matrona.[28]

Within various contexts in Terrace House 2, nine richly decorated distaffs with looped ends and fragments of similar objects were found; none shows signs of wear.[29] The group is comparatively homogeneous.[30] The characteristic part of the objects is the loop at the lower end, which is attached to a short, decorated or smooth rod with small, pointed, leaf-like protrusions. The lower end of the loop has some further decoration in the form of a small deltoid projection, a palmette or another, more detailed object. The upper ends are decorated in various ways: animals, pine cones, geometrical objects and many other subjects can be found. Some of the most richly decorated examples are topped by a carved figurine

(Fig. 13.7a–b), often depicting Venus pudica.[31] The choice of the motif is not mere coincidence.

Comparing this object to functional distaffs, the incompatibility is obvious. The decorated tools do not offer enough space to arrange a reasonable amount of wool or yarn for spinning, and the figurine makes the arrangement even more difficult. The pointed leaves at the connection of rod and loop as well as an additional decoration at the lower ending also make the practical handling rather difficult.[32]

Unfortunately we are not aware of all the original locations of the decorated distaffs. However, it becomes obvious that their function in Terrace House 2, just like in burial contexts,[33] is not related to everyday household use. It therefore seems legitimate to attribute a symbolic role within the female sphere to these decorated distaffs. As we know from written and epigraphic sources, the domestic sphere was the housewife's duty.[34] When visualizing housekeeping in the antique world, undoubtedly the tools for textile production and the decorated distaffs from Terrace House 2 play an essential role.[35] It seems likely that the decorated distaffs were a symbol of the social status of the matrona, and were kept or even exhibited in the public area of noble Ephesian houses. [36]

Fig. 13.7 a–b: Decorated distaff, Terrace House 2, Ephesus.

This short paper is meant to draw the archaeological community's attention to Roman era artifacts for textile processing, in particular those objects uncovered in the eastern provinces of the Roman

Empire. The small finds of that group are frequently underrated, although a careful study will establish the same significance as other finds.

Future research, based on a bigger sample of published finds, will establish modifications in the shape of two loom-weights during the Hellenistic and Roman eras, such as the change from Hellenistic lentoid to Roman pyramidal loom-weights in Ephesus, as well as a number of individual developments in various regions. Although the different regions of Asia Minor were finally united in the Roman Empire, we can nevertheless expect major regional variations. As a result of these studies, we shall learn more of the use of these tools and of the people who used them.

Notes

1 Lang-Auinger 2003; Scherrer 2000, 100–13; Krinzinger 2002.

2 In the course of a research project carried out by the Institute for Studies of Ancient Culture, Austrian Academy of Sciences, the majority of the finds which were excavated within the past forty years are being prepared for a comprehensive publication. Lang-Auinger 2003; Thür 2005; Krinzinger forthcoming. My personal research work was financed by the *Österreichische Nationalbank* (OeNB) and the *Austrian Academy of Sciences*, and the attendance at the conference by the *Österreichische Forschungsgemeinschaft*.

3 I do not believe that the present knowledge of these artifacts is representative for the existence of the objects in total. Small finds remain often misinterpreted or unidentified. Due to these and other reasons, for example, financial issues, they are often considered as not worthy of publication.

4 Both *insulae* have individual building, rebuilding and destruction phases.

5 Similar loom-weights, so far unpublished, were found in the stratigraphical complexes of the Hellenistic period under the Basilica Stoa in the State Agora and in the Tetragonos Agora. I owe V. Mitsopoulos-Leon, Chr. Rogl and P. Scherrer my thanks for providing me with this information.

6 S. Ladstätter provided me with this information in personal conversation; cf. Krinzinger forthcoming. These new finds can be linked with the existence of more than 20 lentoid loom-weights that were found in a foundation trench in the street immediately south of Terrace House 2 in 1984; Vetters 1986, 97 (the loom-weights are not mentioned there, only the burials of classical age). As of yet, we have no archaeological evidence for professional textile processing or for any other building structures that indicates industrial textile working in Ephesus. But in an inscription found in the Vedius Gymnasium, the *synergasia* (professional association) of wool and linen dealers, and linen- or towel-weavers, are mentioned: Börker (ed.) 1979, No. 454.

7 Voigtländer 1982, 102 Nr. 373ff.; Wallrodt 2002, 179–196; Davidson & Burr-Thompson 1943, 79 Nos. 142 ff.

8 Pyramidal loom-weights with two holes are, for the most part, older than the weights with one hole, but development and traditions show big regional differences.

9 Voigtländer 1982, 102 Nos. 387ff.; Davidson 1952, 162; Sackett & Cocking 1992, 401–402, Pl. 330.

10 Sackett & Cocking 1992, 402 W 14, Pl. 333.

11 Henig & Fulford 1984, 251; a doughnut-shaped object made of clay, stamped by a gem, described as a spindle-whorl: Touchais 1999, 902, Fig. 239.

12 Tekkök et al. 2001, 363, 370–371, Pl. 26.

13 E. Trnka called my attention to this interpretation. Cf. discussion in Wallrodt 2002, 183–185.

14 Cones and pyramids of lead, some stamped on the bottom, are not necessarily loom-weights. Meriç 2002, 138–139 Pl. 87; Voigtländer 1982, 108, Nos. 419–20; Wiegand & Schrader 1904, 322, 393 Fig. 521–2; Branigan 1992, 371, M326–M328.

15 Ling 1997, 180.

16 Trinkl 2003.

17 The individual loom-weights of the same set are not necessarily of identical shape and weight; Sackett & Jones 1992, 23 Pl. 15. Hoffmann 1974, 319 ff.

18 Ling 1997, 180.

19 Jilek 2005; Gostencčnik 2001, 571–579.

20 Ladstätter 2005.

21 Waldbaum 1983, 62–3 (includ. ref.), 152 Nos. 242–9. 1003, Pl. 17.58; Eiwanger 1981, 99, Cat. II.669–670; IIIa.127, Pls. 86, 88. An unpublished spindle hook of the same shape was found in a trench in front of the Celsus Library in 1989; Efes Müzesi Inv. 25/68/89.

22 Length: 5.8 cm; Width: 1.8 cm.

23 Unfortunately, no other similar object has been found.

24 A detailed discussion of the objects for textile production will be published together with the other finds in the coming years. In that connection the interaction with all other find categories can be established.

25 König 1987, 129–141.

26 The ensembles of spinning objects are numerous. Therefore, I mention only a set that was found in Ephesus itself. A spinning set of bone was found together with many other burial objects inside a sarcophagus of a young woman and her child from the beginning of the 3rd century AD; Trinkl 1993, 38–40; 1995, 67–69, 73–77. For looped distaffs as burial objects, cf. Cremer 1998–1999, 327–332, esp. 328. For spinning utensils in graves, see the chapter by D. Cottica, this volume.

27 Waelkens 1986, 12; Cremer 1996, 135–144.

28 Cremer 1992, 41; Trinkl 2000–2004; see the chapter by Larsson Lovén, this volume.

29 No distaff has been found in Terrace House 1 so far. One possible reason is that Terrace House 1 was used till the 7th

century, whereas Terrace House 2 was abandoned after a series of earthquakes in the third quarter of the 3rd century AD; later housing phases lie much higher and mostly seal the destruction layers of the earthquakes. A small number of distaffs with loop ends were found in some other places in Ephesus, but they will not be discussed here, Trinkl 2004.

30 So far no other type of distaff occurs in our finds.

31 Cremer 1996. Many of the distaffs with a loop end can be dated from their complexes to the 2nd–5th centuries, but a stylistic development is recognizable in the figurines and bases that connect figurine and rod; Trinkl 2002, 31–33.

32 We have seen functional loops as ends of handles or keys, but in all these cases, the loop is smooth and undecorated.

33 Trinkl 1994, 80–86; see D. Cottica, chapter 36, this volume.

34 Eichenauer 1988, 90; Krause 1994, 130ff.; Barber 1994, 232–256.

35 Larsson Lovén 1998b, 85–95; Trinkl 2000–2004; 2004.

36 The finds in the Terrace House 2 in Ephesus provide some new information about the group of decorated distaffs, for most similar finds have come from burials. Biró 1994, 195–229 especially emphasizes the role of the birth-giving Aphrodite.

14 ‘Dyeing’ in Ancient Italy? Evidence for the *purpurarii*

by Lisa Hughes

The term purpurarius *is problematic. Traditionally, the* purpurarius *has been associated with the production of purple textiles. This paper challenges this assertion by examining other types of goods that would have been beneficial for this individual to produce and to sell, namely foodstuffs, dye, and pigment. The discussion then turns to an examination of the epigraphic evidence in Italy. This form of evidence produces its own set of methodological complexities and uncertainties. Examples from Rome illustrate that the Veturii family did not monopolize the dye trade. As well, the evidence points to the idea that production and selling of purple goods did not necessarily go hand in hand in the capital. Finally, this paper questions the exact nature of the appearance of an occupational title in an inscription. What becomes apparent is that the designation of* purpurarius *coincides with a managerial position within the trade.*

From both economic and social perspectives, freedslaves made important contributions to Roman society.[1] The occupations that they held in daily life formed the basis of the Roman economy; to reaffirm the important contribution that they made, some of these individuals would proudly portray their occupations on their funerary monuments and dedicatory inscriptions.[2] Their occupations ultimately provided them with the wealth needed to compete with the lifestyles of their wealthy freeborn counterparts.[3] This is especially true of one group of Roman craftsmen known as

the *purpurarii* (sg. *purpurarius /a*) who have traditionally been deemed as the purveyors of purple textile, a fabric symbolic of wealth and luxury during the late Republic and Empire. Through an examination of the literary, epigraphic, and archaeological evidence, it will become apparent that the *purpurarii* and members of their *familia* could produce or sell a number of purple goods, other than textile, from their workshops. It is necessary to investigate the types of goods that would be beneficial for the *purpurarius* to produce and to sell, namely, foodstuffs, dye, and pigment. Inscriptions from funerary monuments and dedicatory inscriptions will help to isolate where these goods were produced and to illustrate that the *purpurarii* acquired this title because of their managerial positions within the trade.

The *purpurarius/a* could only stand to gain substantial profit by producing and selling a variety of purple goods in the workshop.[4] For example, one such commodity was the meat from the murex shell. This was a delicacy in the Mediterranean diet and could also be used for medicinal and religious purposes.[5] The dye-producing organ from the same shell could be used to produce Tyrian purple dye or else pigment. It is important to distinguish between dye and pigment. Dye is a solution used to color fabric, whereas pigment is a color found in a non-dissolvable form of powder. It is probable then that the *purpurarius/a* was not only responsible for dyeing wool, but also for producing purple pigment that could be used for wall painting. The variety of goods that these individuals could produce or sell earned them the right to a special title on their funerary monuments and dedicatory inscriptions.[6]

Where did a *pur purarius/a* obtain purple for dye and pigment? The evidence, both literary and archaeological, provides important clues. The *purpurarii* obtained purple in a processed form from neighboring countries, or produced and sold it locally in Italy.[7] For instance, Pliny informs us in *HN* 35.26.45 that the murex shell used to make purple pigment was available in Greece (e.g., Laconia), in North Africa (amongst the Gaetulians corresponding to modern Morocco), and in Italy at Puteoli.[8] For Pliny, the best purple was that from Puteoli. To achieve variants in color the *purpurarius* added urine to a stronger solution of purple made of murex shell, or he produced this color from plants or insects.[9] For the producer of purple, coastal areas, the main source for the murex, had to be in

close proximity to the production areas.[10] The archaeological evidence also supports widespread production of purple dye during the late Republic and Empire. Recent site reports from Roman Eretria exemplify how heaps of murex shells lined the floors next to the rooms holding dye basins. Similar floor plans of dye houses are also evident at Ostia and Pompeii.[11] One could then technically produce both purple pigment and dye in the same workshop.

Now that we know where the *purpurarius* obtained the materials used for purple, we must ask whether a *purpurarius* produced both purple pigment and textile in the same workshop. In Pliny's discussion of purple paints made in the *purpurarii* workshops, he takes us through a step-by-step process that involves both the dyeing of wool and the creation of pigment.[12] First, a bronze or copper cauldron that fit into a stone furnace was necessary. This cauldron was both a component feature of the textile dye house and as is apparent in the text of Pliny, was the very same apparatus used for creating pigment.[13] The formation of pigment and the dyeing of wool occurred at separate times, as he states in the beginning of the passage that the clay absorbed the dye more quickly than wool. The first batch that Pliny refers to must be the wool dyeing process whereby raw colors are boiled in the cauldrons. The second batch refers to the production of pigment. Here, white clay (*creta argentaria*) was added to the dye solution indicating a secondary dyeing stage. The purple liquid remained in the dyer's vat, and the clay's highly absorptive properties required its addition to the second batch in order not to soak up the color used to dye the wool. The multiple repetitions of this process alludes to the creation of different hues of purple pigment: dark, pale, blue, and red as reported by Vitruvius.[14] The *purpurarius/a* was able then to produce both purple pigment and dyed wool. Pigment could be sold to patrons to supply their artisans for the purpose of creating wall murals in the more fashionable houses of the area. Pliny confirms this by stating that purple was one of the colors that a patron supplied to the painter at his own expense.[15] Patrons needed to purchase the pigment and this could be accomplished at the workshop of the *purpurarius/a*.

It is now necessary to outline not only the familial relationships, but also prominent societal positions held by these individuals both in Rome and its environs. To do so, I have collected a total of 21

inscriptions from Italy bearing the word or an abbreviated form of *purpurarius/a*, a select few of which will be discussed here.[16] Nine examples come from the city of Rome, while six come from outside the capital within the confines of Italy. The *purpurarii* conclusively identifiable as *liberti* are those who have the abbreviation "l", standing for *libertus*, in their inscriptions. When the designation of *libertus* is missing, one must rely on the presence of the cognomen that could reflect the freed-man's former slave name.[17]

The *purpurarii* at Rome made their presence felt in a variety of social contexts. The Emperor Augustus' wife, Livia, had her own personal *purpurarii* employed in the Imperial household.[18] They set up businesses in the popular shopping districts, such as the *vicus Tuscus* located between the *Forum Romanum* and the *Forum Boarium*.[19] But who managed such operations? Previous scholarship has shown that *purpurarii* were husband and wife teams consisting of *liberti* or manumitted slaves. Moreover, according to some scholars, members of the *gens Veturia* monopolized this industry at Rome during the late Republic and early Principate.[20]

To say that the *gens Veturia* monopolized the dye trade in Rome is perhaps reading too much into the evidence. Out of a total of nine inscriptions found in the capital bearing the word *purpurarius/a*, the name *Veturius* appears in only four.[21] A marble funerary relief originally from the city of Rome[22] and now located in the Museo Civico at Fiesole (Fig. 14.1), provides one such example of a family other than the Veturii employed in the purple trade. Moreover, it also shows a rare instance when an iconographic representation accompanies an inscription with the word *purpurarius/a*.[23] This carved relief shows three bust portraits, a man flanked by a woman on either side, and includes a fragmentary and problematic inscription that reads,

> *[----]a. P. Clodi. Philonici. Euraniae. Mu(lieri) Purpurari. de Vico [----].*
>
> [----]a. To Publius Clodius Philonicus and his 'wife' Eurania, *purpurarii* from the *Vicus* [----].

Unfortunately, only the last letter, 'a', remains in the name of the

first individual represented on the Fiesole relief. The name in the nominative case most likely corresponds to the dedicator, the first female carved on the relief.[24] The rest of the inscription, written in the dative case, informs the viewer that Publius Clodius Philonicus and, perhaps, yet not likely, his wife (*mulier*),[25] Eurania, are likely *purpurarii* or that Eurania herself is the sole *purpuraria*.[26] It is probable that Eurania, Publius Clodius Philonicus, and the third figure named in the inscription were all *purpurarii* and perhaps acted as managers of the operations, a suggestion that will be explored further below.[27]

The next problem lies with the location of the shop. The inscription on this relief supplies the word '*vicus*' or quarter to indicate where this family performed their trade, but the word following, the one that provides the specific location, is missing. We can infer that this shop was situated either in the Tuscan or Iugarian quarters because these two *vici* appear most frequently in the epigraphic record of the *purpurarii*.[28] Did this family actually produce the goods in these particular districts? Likely not, as space was an issue. If, for instance, this family engaged in the dye trade, an area of considerable size had to be allotted for the installations.[29] These individuals were then dealers of purple goods, a claim substantiated by Loane.[30] If their shop was on the *vicus Tuscus,* this group was probably selling luxurious clothing dyed in purple, since the *vicus Tuscus* was a popular spot to purchase clothes.[31] This has important ramifications for it has been suggested that most individuals both produced and sold goods in the same shop.[32] Inscriptions outside Rome, in contrast, do not indicate specific references to the location of the shop within a specific town or city.

Fig. 14.1: Funerary relief of an unidentifiable figure, Publius Clodius

Philonicus, and Eurania, purpurarii. Located in the Museo Civico, Fiesole. Photo by the author.

Outside the capital, there are examples of prominent *purpurarii*, but previous scholarship is silent regarding the types of familial and occupational relationships that these individuals held.[33] In terms of single commemorations, that is, where only one person is named on the inscription, there is a tendency for the *purpurarius* to have acquired an elevated social position. These individuals tend to emphasize their political and religious roles in public life. For example, at Puteoli located in southwestern Italy, there are a total of two extant examples[34] of single commemoration inscriptions naming *purpurarii* extant. One[35] belongs to Cnaius Haius Doryphorus who was an Augustalis in the second century CE.[36] It reads,

N. Hai. Doryphoro
Purpurario Aug.VII
Dupliciario vixit
annis XXXXVIIII
M. VI Diebus XXIX

To Haius Doryphorus, *purpurarius*, *Augustalis dupliciarius* VII, he lived for 49 years, six months, and 29 days.

There is no mention of any other participant in this inscription, but it does give important information about the elevated status of this individual in civic life: he attained the position of *Augustalis*, a public honor ascribed only to a freedslave.[37] That a freed-slave had acquired such high honors should not be such a great surprise, especially since purple goods from Puteoli were considered some of the finest. A similar situation appears in a dedicatory inscription from Truentum, located in eastern Italy. *CIL* 9.5276 reads,

C. Marcilius
Eros Purpur.
V. Vir. Truentii

Caius Marcilius Eros, *purpurarius*, *quinquevir* of Truentum.

C. Marcilius Eros was a *quinquevir*, a commissioner responsible for the allotment of public funds.[38] The *purpurarii* in these two inscriptions are not only named with their particular trades, but also their roles in public office. This indicates that these individuals prospered economically and socially, as a result of their occupations. In an example from Capua,[39] a *purpurarius* played a role in local religious life. This inscription does not come from a funerary monument, but rather a dedicatory inscription dating to the consulship of Rutulius and Mallius, c. 105 BCE. Here, P. Servius, freed-man of Numerus, *purpurarius*, was an attendant responsible for maintaining the cults of Castor and Pollux as well as of Mercury.

Other funerary monuments found in Italy draw parallels to the *familia*-run operations found in Rome. A second inscription from Capua, *CIL* 10.3973, reads,

C. Minati. C. l. Philodami. Purpur. Minatia C. l. Fausta fecit sibi et patro.

To Caius Minatius Philodamius, freedman of Caius, *purpurarius*. Minatia Fausta, freedwoman of Caius made it for herself and for her patron.

A woman by the name of Minatia Fausta, freed-woman of Caius, commissions a funerary monument for C. Minatius Philodamius, *purpurarius*, who was her former master and her patron. An example from Cisalpine Gaul, *CIL* 5.1044, reads,

M. Pullio M. l. Casto
M. Pullio M. l. Fusco
Purpurario
Pullia M. l. Prima
M. Flavius Ianarius
M. Pullius C. l. Hormus Purpurar.

To Marcus Pullius Castus, freedman of Marcus,

> Marcus Pullius Fuscus, freedman of Marcus, *purpurarius*. Pullia Prima, freedwoman of Marcus, Marcus Flavius Ianarius, Marcus Pullius Hormus, freedman of Caius, *purpurarius*.

In this instance, Pullia Prima, freedwoman of Marcus, Marcus Flavius Ianarius, Marcus Pullius Hormus, freedman of Caius, *purpurarius*, dedicated the monument to their deceased relatives, Marcus Pullius Castus, freedman of Marcus, and Marcus Pullius Fuscus, freedman of Caius, *purpurarius*. As in Rome, when two or more names appear on the inscriptions, this indicates that the individuals found on the inscriptions most likely worked together in the trade, and did so prior to their manumission.[40]

But, the question remains: why, then, are specific individuals designated as *purpurarii* on these inscriptions? Perhaps, as suggested earlier with the Fiesole example, the specific reference names the patron(s) or manager(s) of the operations. It is evident that both the production and selling of purple goods involve multi-tasked operations that one person alone could not perform.[41] Individuals, men or women, or groups of individuals could oversee the work that took place in the shops. Those that did not have an occupational title attached to their names most likely took part in the day-to-day activities. Moreover, other members who engaged in workshop activities (i.e., slaves, freedslaves, and freeborn) may not even have been included in the inscriptions. Rather it is more probable that those individuals named with occupational titles were the managers of the operation, whether it involved the selling or producing of goods.

The identification of *purpurarii* in ancient Italy is replete with methodological complexities. The reading of the inscriptions as well as the identification and translation of the word *purpurarius/*a is problematic at best. It has been suggested here that the *purpurarii* were a select group of individuals, both men and women, acting in a managerial capacity who had the potential to produce or sell a variety of luxurious purple goods in their shops, not just that of textile. Individuals continued to don and consume luxury items in the Roman world. Therefore, the production and selling of goods in purple was essential in Italy and its neighboring provinces in the

Empire. The profit and prestige that resulted from the production and selling of purple goods are also well attested on the inscriptions of prominent freedslaves and their *familia* in Roman Italy.

Acknowledgements

I am grateful to Hanne Sigismund Nielsen and Aaron Hughes for valuable comments and suggestions concerning this paper. Any mistakes are my own.

Notes

1 Treggiari 1967, 244.

2 In the ancient literary sources, traditional aristocratic viewpoints scorned freedslaves engaged in commerce, Cicero. *De Officiis* 1.42, 2.25. The epigraphic evidence clearly shows something else is at play.

3 Joshel 1992, 82.

4 Forbes 1956, 112–122.

5 Bélis 1999. She notes that the organ used for the dye, the flower, is different from the edible portions, the neck and liver.

6 *Purpurarii* seem to be the only ones amongst the dyers who single out their color on inscriptions. Literary sources, namely Plautus, however, indicate a variety of dyers, *Aulalaria* 510, 521. See also Larsson Lovén 1998a, 75.

7 Wild notes that the purple dyeing process called for meticulous skill and great labor. Wild 1988, 61.

8 Pliny, *Nat. Hist* 35.26.45.

9 Burford 1972, 78; Sebesta 2001, 69.

10 For early examples of dye houses, see Barber 1991, 228–229.

11 Forbes 1956, 98; Wild 1970, 79–82; Schmid 1999, 278.

12 *Nat. Hist.* 36.26.45.

13 Scientific experiments have been conducted that question the accuracy of Pliny's account of the dyeing process in *Nat. Hist.* 9.36–41. For discussion and bibliography, see Michel & McGovern 1990.

14 Vitruvius, *De Architectura* 7.13.1.

15 *Nat.Hist.* 35.11.29.

16 This examination of *purpurarii* in Italy is part of a larger project that investigates the types of goods that these individuals may have produced and sold in various towns in the Empire.

17 Treggiari 1967, 250. It is important to note, however, that the presence of a cognomen does not necessarily reflect the name of a freedslave. It could also potentially refer to a freeborn individual.

18 Treggiari 1975, 54.

19 Joshel 1992, 107.

20 Loane 1938, 75–77. See also Treggiari 1979, 71–72; Treggiari 1980, 54–55; Dixon 2000–01, 12 and especially 2001.

21 *CIL* 6.37820, *CIL* 6.9489; *CIL* 14.2433, *NSc* 1922, 144 = *AE* 1923, 59. Other inscriptions that do not have members of the *gens Veturia* named as *purpurarii* include *CIL* 6.9843, 9845–48.

22 *CIL* 6.9848.

23 Larsson Lovén 1998, 77, Fig. 2. Here, in this example from Parma, an iconographic representation accompanies the inscription. The freedslave, Caius Pupius Amicus, dedicates the monument to himself and his family.

24 This could be the woman's cognomen.

25 The abbreviation 'Mu.' is also problematic. It could stand for *mulie*r or wife, a designation that appears infrequently in *CIL* 6; or it could also be some abbreviated form of Eurania's cognomen.

26 To have female *purpurariae* commemorated on a funerary monument is not uncommon as two other examples from Rome do just that, *CIL* 6.9846, *CIL* 6.37280. Also, there is Lydia, the *purpuraria*, mentioned in Vulg. *Acts* 16.14.

27 For the possibility of reading this as '*purpurarii',* see Treggiari 1979, 71.

28 *NSc* 1922, 144 = *AE* 1923, 59, '*Vicus Iugarius*'; *CIL* 14.2433, 2 '*Vicus Tuscus*'.

29 Schmid 1999, 275–278.

30 Loane 1938, 75. Loane claims that the best Tyrian cloths were imported and that the city was not a center for dye preparation.

31 Loane 1938, 75, 131; Morel 1987, 151. It is important to note that only two other inscriptions naming *purpurarii* reveal the location of the shop in Rome, e.g., '*Marianeis*', *CIL* 6.37280 and '*Transtiberim*', *CIL* 6.9847.

32 Joshel 1992, 71.

33 D'Arms 1981, 128, 139.

34 *CIL* 10.1952, *CIL* 10.540.

35 *CIL* 10.540.

36 D'Arms 1974, 110, note 10. D'Arms notes that this particular inscription was found in Salerno with Mommsen correctly attributing it to Puteoli.

37 D'Arms 1974, 110. See also Gradel 2002, 229–230.

38 The cognomen Eros indicates that this individual was a freedslave or the son of a freedslave.

39 *ILLRP* 712.

40 Boudreau Flory 1978, 85.

41 Joshel 1992, 135, 144–145.

15 Local Cloth Production in Medieval Turku, Finland

by Heini Kirjavainen

The Åbo Akademi textile and textile tool finds complete the picture of Finnish medieval cloth production in an urban context. The textiles and tools of production date from the 14th and 15th centuries. The cloth bindings used 2/2 twill, plain weave and 2/1 twill. Some of the textiles were fulled, napped and sheared as well. Textile tool finds for almost every phase of cloth production, from spinning to cloth finishing, were excavated. Horizontal loom parts and tools were discovered, but tools associated with upright looms could also be found. Along with these artifacts were found many kilos of raw wool and some bunches of hemp fibers. Linen cloth and some linen weft yarns were found on textiles. Nettle and hemp fibers in sewing threads of various leather artifacts were present, too.[1] *A comparative fiber analysis was conducted between the cloth types (fulled woolen cloth, fulled coarse woolen cloth, 2/2 twill cloth, plain weave cloth and 2/1 twill cloth) and present-day wool fibers from primitive Åland sheep and Finnish landrace, and some raw wool finds. Coarser cloths were made of local hairy or a hairy medium type of wool but fulled woolen cloths and some fine 2/2 twill cloths were finer, with fibers of a medium and generalized medium type. Cloth production was arranged in the specialized areas at the Åbo Akademi site, some of them overlapping with the processing of wool or vegetable fibers and spinning. Two concentration areas could be connected with weaving.*

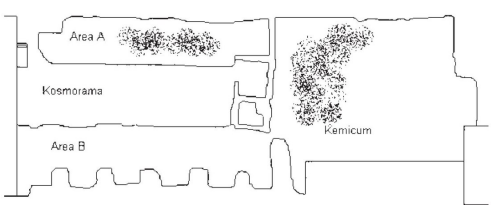
Introduction

The archaeological excavations were made in Turku, Finland, by the Turku Provincial Museum in the year 1998. The so-called Åbo

Akademi site was situated in the central area of medieval Turku, near the Dome and the marketplace called Suurtori. It belonged to the Mätäjärvi quarter, and as a dwelling site, it had many connections to different artisanal activities, mainly of leather working and shoe making,[2] but also cloth weaving.[3] The textile and additional tool finds of other urban excavations in Turku are very sporadic and minor compared with that of the Åbo Akademi artifacts.

The unique find of 800 pieces of textile was excavated. This is the largest collection of medieval archaeological textiles in Finland. Along with many kilos of raw wool found in the excavation site, 135 tools or tool parts could also be related to these textile finds. They could support the assumption of the development of urban crafts. These tools or tool parts could be related to almost every phase of textile production, from sheep-shearing to a finished cloth product. It seems that the most intensive cloth production occurred between the years 1350–1500, in the same areas where the most of the textile fragments and raw wool were found.[4] Textile fragments were composed of 98% wool, 1% goat hair and 1% other fibers, including that of animal hair and vegetable fibers such as flax, hemp and nettle. Evidence of wear and use were found on the fabric pieces, such as cut seams and hems, stitches and stitch-holes, button holes and cut edges.[5] Thick cultural layers contained dung and other remains of human activities.[6] Textiles and textile tools were preserved primarily in the lowest layers and spread over two areas at both ends of the excavation site (Fig. 15.1).

Fig. 15.1: Plan of the excavation area. Textile and textile tool concentrations on marked areas.



Domestic or Professionally Produced Cloths?

The most common binding is 2/2 twill at 55%, then plain weave 39% with 2/1 twills at only 6%. One explanation for the emergence of four-shafted twills could be that the weavers specialized in manufacturing one type of cloth, for example 2/2 twills, which were also available fulled and dyed with imported colorants:[7] these two kinds of cloth types are most striking in the Åbo Akademi textile materials. When it comes to the binding itself, medieval 2/2 twills have a long tradition in Finnish pre-historical weaving, using warp-weighted[8] or other types of upright looms. Loom-weights have not been found in the Åbo Akademi site, but some weaving implements that were used with upright looms have survived.[9] As early as prehistoric times, woolen twill cloths were used as outer garments and those woven in plain weave as undergarments.[10] During the Iron Age, woolen plain-weave cloths were rare, and the majority were made of vegetable fibers, such as flax, hemp and nettle, but unfortunately, they have been inadequately preserved.[11] In the Åbo Akademi textile material, woolen plain-weave cloths are fine and light, and they may have been woven for undergarments. Fabrics woven in 2/2 twills or 2/1 twills are much heavier and thicker, and better suited as outer garments for the northern climate. Because of the similar appearance of plain-weave fabrics in Northern Europe at the turn of the 14th century, horizontal looms may have been more common there.[12] This suggestion may be acceptable because plain weaves are in greater number than the twill weaves.

Furthermore, parts of horizontal looms and weaving equipment have been found in the site.[13] The low number of 2/1 twills gives no indication as to whether they were woven with upright or horizontal looms. If they were woven at the Åbo Akademi site, either method would be possible. They may have been more numerous before the 14th century, but there are no indications of changing production technology at the turn of the 14th century regarding them.

It seems more likely that 2/2 twill weaving continued with upright and horizontal looms during the Middle Ages at the Åbo Akademi site. Moreover, each loom type may have served a specific function for particular cloths. Coarse woolen cloth called *sarka* in Finnish is mentioned in medieval documents,[14] but these sources do

not discuss the type of looms used. However, a few simple selvages and a starting border have been preserved, which may indicate the use of a horizontal loom. As several textile researchers have already stated, horizontal looms have been associated with the rise of commercial textile production.[15] The Åbo Akademi horizontal loom parts and various weaving tools do not help us in this respect. But when did the first horizontal looms arrive? They could have come with foreign weavers from Hanseatic (c. 14th to 16th centuries) towns or migrated from east to west. We can tell that the Åbo Akademi horizontal loom finds are the oldest by far in Finland, dating back to the 15th century.[16]

We would like to assume that there was some kind of organized production at the site, especially when considering the uniformity of the cloth and the abundance of raw wool. Simple weaves and similar thread counts appear in warp and weft because they were quick to create and weave. Once cloths had been woven, specialized after-treatments may have been used.[17] These standardized qualities of textiles have been calculated with variation, which are expressed with a standardization co-efficient. It is low in professionally woven fabrics and higher in domestic woven cloths (Fig. 15.2).[18]

Imported or Locally Produced Textiles?

This question was approached through fiber analysis (Fig. 15.3). It was conducted by measuring 100 wool-fiber diameters within each sample. This gives a hair-diameter distribution, which indicates the sheep-fleece type.[19] The percentage of medullation and dyed fibers was also recorded. Most fiber samples were taken from the textile pieces and sent to York for dye tests.[20] There, fibers were compared with each other and to known primitive northern short-tailed, double-coated breeds of sheep: Åland sheep and Finnish landrace. The fiber samples were also compared with different raw wool finds from the excavation site. Coarser cloths (fulled coarse woolen cloth, most of the 2/2 twills, plain weaves and 2/1 twills) were made of local hairy or a hairy medium type of wool, with a wide range (>100 μm) of fiber in a skewed and/or continuous distribution. Fulled woolen cloths and some fine 2/2 twill cloths had a finer fiber type of medium and generalized medium wool. They had a narrower range (<50–60 μm) of fiber, in a skewed or symmetrical

distribution. These two latter cloth types had atypical fiber distribution for the local sheep race, and were more characteristic of finer woolled sheep. Thus, I believe those cloth types had to have been imported. Raw wool fibers matched with coarser cloth types and are surely locally produced–some of them woven at the Åbo Akademi site, but in nearby areas, as well. The dye test results of TLC chromatography[21] also support this conclusion, for imported dyers' madder was found in textiles woven of local wool.

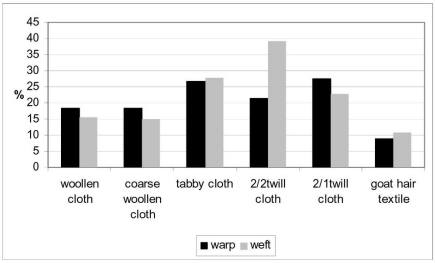
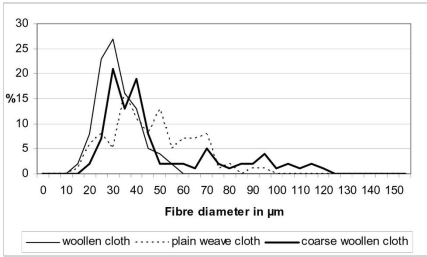


Fig. 15.2: Variation in cloth types.

Finnish historical sources[22] mention cloth importation from Flanders, England and Germany.[23] The textile trade did not follow a straightforward path from the place of origin to Turku, but occurred via Hanseatic towns like Lübeck, Danzig and Reval.[24] Furthermore, smaller-scale cloth trade called 'peasant sailing' was carried on along the Finnish coastline via Vyborg, Stockholm and Reval.[25] The first mention of local cloth manufacture is from a 16th-century account book.[26] It has been supposed that local cloth production was regulated through different statutes, although no written sources have survived which attest to this.[27]

The weaving of everyday textiles may have been for local consumption, but an increase of economic wealth and foreign contacts may have created pressure for commercial textile production.[28] The organized cloth production and trading environment in Turku may have existed at the very site of Åbo Akademi during the 14th and 15th centuries. There, finished cloth product was the focus. But in order to manufacture it, institutional statutes and regulations were there to control and restrict the production and trading.

Fig. 15.3: Fiber diameters in some cloth types.



Notes

This textile research is a part of a larger archaeological research project called 'From village to town. Changing ways of life in Southwest Finland from the 10th to the 16th centuries'. The project is carried out with the University of Turku and the Turku Provincial Museum. The project leader is Professor Jussi-Pekka Taavitsainen from the University of Turku.

1 Kirjavainen 2003d, unpublished report.

2 Harjula 2002, 127.

3 Kirjavainen 2002, 346–351; 2003a, 4–18; 2003b, 12–19.

4 Kirjavainen 2003c.

5 Kirjavainen 2003a, 6.

6 Seppänen 2002, 357.

7 Kirjavainen 2002, 348; 2003a, 6; 2003b, 13.

8 In Finland the oldest probable loom-weights date from the 7th to the 8th centuries, see Erä-Esko et al. 1995, 87. The oldest clay weights with holes date from the 1st–3rd centuries. They have been found in various contexts (cremation and inhumation burials, ancient hill forts and habitation sites) up to the 13th century, which is the turning point from pre-history to the Middle Ages in Finland, see Antell 1999.

9 A connection with the warp-weighted loom is a sword beater, which is similar to the Bryggen finds in Bergen, Norway: see Øye 1988, 82. Needle-like tools (3 pieces), which have a hole at the butt end, and three weft bobbins, which bulge at one end, can be also connected with an upright loom: see Kirjavainen 2003c.

10 Erä-Esko et al. 1995, 87.

11 Lehtosalo-Hilander 2001, 15. Pre-historical textile fragments have been preserved mainly in inhumation burials, Lehtosalo-Hilander 2001, 7–8.

12 Maik 1998, 217.

13 Loom parts found: two wooden pulleys, a pulley support, a heddle horse, four heddle rods. Each of them is fragmentary. Weaving tools, which could be combined with a horizontal loom, include a boat shuttle and a possible reed hook, which is fragmentary: see Kirjavainen 2003c.

14 For example, see *Finlands Medeltidsurkunder*, Hausen (ed.) 1910–1935, Vol. IV, letter 3001, in which there are many mentions of using coarse woolen cloth as payment for taxes, land sale and barter transactions.

15 For example Hoffmann 1974, 258, 261; Maik 1998, 217.

16 Kirjavainen 2003c.

17 Hoffmann 1974, 284; Gjøl Hagen 1988, 115. After-treatments like dyeing, fulling, napping and shearing could be used separately or all at once.

18 Gjøl Hagen 1988, 128; Kirjavainen 2002, 348; 2003b, 15–16.

19 For example, Ryder 2000, 4.

20 The tests were conducted by Penelope Walton-Rogers at the York Textile Research in Archaeology. The colorants used were dyers' madder (*Rubia tinctorum L.*), bedstraw (*Galium verum L.* or *Galium odoratum L.*), woad (*Isatis tinctoria L.*) and alder bark (*Alnus glutinosa L.*). Also an unidentified yellow substance called 'yellow X' was

found, which has been found in other Scandinavian textiles as well, see Walton Rogers 2001.

21 Walton Rogers 2001, unpublished report.

22 The main source for this is *Finlands Medeltidsurkunder*, Hausen (ed.) 1910–1935, vols. I-VIII.

23 Taavitsainen 1982, 24.

24 Kerkkonen 1981, 468.

25 Kerkkonen 1959, 31. Imported cloths were meant for the gentry, clerks or wealthy burghers, not for peasants, Kerkkonen 1959, 133.

26 Melander 1914, 2.

27 Kuujo 1981, 165.

28 Henry 1998, 164.

16 Woolen Textiles in Archaeological Finds and Descriptions in Written Sources of the 14th to 18th Centuries

by Klaus Tidow and Eva Jordan-Fahrbach

In northern Germany and adjoining regions, a great number of textiles have been found during excavations. They originate from the Bronze and Iron Ages, the Middle Ages and the Early Modern period. They offer a comprehensive summary of the textile fibers used in former times, and provide information about manufacturing methods and employment. There is a lot of woven woolen material among the archaeological textile finds. In many of the towns, the statutes of the weavers or cloth-makers' guilds have survived. They described the different qualities of woolen weaving at this time. Moreover, some show cards of weaving patterns demonstrating the woolen fabrics commonly used in those days. The subject of this contribution is to demonstrate the changes of the manufacturing of woolen cloth during the late Middle Ages and the Early Modern period by viewing analyses of excavated woolen fabrics and descriptions of contemporary documents.

Sites and Contexts of Finds

Textiles from the early Middle Ages have been preserved mainly in the elevated settlements of the German and Dutch inhabitants of the North Sea coast.[1] These elevated settlements rose over time through deposits of soil containing clay, manure and refuse. The most important sites along the German North Sea coast are Elisenhof, Hessens, Niens, Oldorf and Dorum (7th–9th centuries).

Other early medieval textile finds come from cemeteries. They have been found in graves, usually in connection with weapons and iron or bronze jewelry. The Frisian cemeteries of Dunum and Zetel (8th–9th centuries), and the Saxon cemeteries of Liebenau (5th–9th centuries) and Ketzendorf (8th–9th centuries) are amongst the most important sites.[2]

From the Viking era, the textile finds of Haithabu/Hedeby are especially important (10th century). They were found in the harbor, in the settlement and in graves.

In the high Middle Ages, the late Middle Ages and the Early Modern period, there were in particular cities with a variety of layers containing cultural evidence rich in textile finds. The most important finds from large-scale surface excavations come from Göttingen, Emden, Schleswig and Lübeck (11th–15th centuries).[3]

But many textile finds of this time originate from cesspits, usually abandoned wells, which were used as refuse pits. Next to organic refuse and broken household goods, they also contained textiles. The majority date from the 15th and 16th centuries, with some few from the 14th and 17th centuries. The largest number of sites has been excavated in Lübeck and Hameln. Göttingen, Höxter, Lüneburg, Einbeck and Braunschweig are also worth mentioning.[4]

In contrast to the Iron Age, there are only a few medieval textile finds from northern German bogs. They survived due to the preservational characteristics of the bog acid. Luckily, they are often complete garments, such as the man's suit from Bernutsfeld (7th–9th centuries) and the cap from Bargerfehn (14th century).

Varieties of Woven Cloth

Our examinations of woolen fabrics of the late Middle Ages and the Early Modern period have led us to conclude that we can speak of 25 characteristic groups. This evaluation is based on binding systems, kinds of yarn, the twist of the yarn, thread count, and the finishing of the material. For the high Middle Ages, a similar figure cannot be established yet because the final technical analysis for the two larger find complexes in our region is still outstanding.

There are finds from Lübeck, Göttingen and Einbeck dating from the 13th and 14th centuries. Other finds excavated in Lübeck,

Hameln, Braunschweig and Göttingen originate from the 15th and 16th centuries.

Tabby, twill 2/1 and 2/2 and tabby with narrow strips of rep are the most important binding systems of the 13th and 14th centuries. The majority of fabrics show a smooth surface, which is achieved by a combination of Z-twisted warp yarns with S-twisted weft yarns. The fabrics are of coarse, medium and fine qualities. Only a few fabrics are very fine. During the 15th century, the combined binding systems mentioned before, i.e., tabby and rep, disappear. Satin emerges as a new binding system.

During the 15th century, new qualities of woolen fabrics, which had only rarely been found in previous times, came to the front. These new fabrics were called 'cloths' if they were made from woolen yarns, and 'worsteds' if they were made from the long-stapled worsted yarns. During the 16th and 17th centuries, both fabric qualities were very popular in northern Germany, although only very few from the 17th century were actually found. However, the above-mentioned cloths and worsteds are documented in pattern cards from the Lüneburg archives. They date from 1678 and show weakly fulled, both medium fine and fine fabrics, and strongly fulled or napped fabrics woven in tabby or twill. Very fine woolen fabrics–worsteds–exist in tabby, rep, extended tabby, twill and satin. Worsteds in extended tabby and rep are very rare. Among the twill worsteds there are light non-fulled and fulled fabrics. Moreover, the very fine twill and satin can be divided into two groups. One can find examples with similar thread counts in warp and weft, and others containing a substantially higher thread count in the weft. The pattern cards from Lüneburg dating from 1678 show almost all of these fabric qualities and their contemporary trade names. Only fabrics in twill 2/1 are missing amongst the worsteds of those between the 14th and 17th centuries.

Trade Names in Guild Rolls

In order to put the contemporary trade names to the excavated woolen fabrics, the technical data from selected written sources were compared to those from the excavations. Obviously, only sources containing sufficient technical data could be used. The following guild rolls were examined: the guild rolls of the 'woolen'

weavers from Lübeck (1477, 1553), Hamburg (1450, 1595), Lüneburg (1432, 1595) Braunschweig (1535) and Göttingen (1476), as well as the guild rolls of the worsted weavers from Hamburg (1613).

It is remarkable that the guild rolls of the 'woolen' weavers of the 15th and 16th centuries mentioned different kinds of *Laken*, but no other trade names. These Laken differ only in color, quality of wool and finishing. Comparing the *Laken* mentioned in the guild rolls from several Northern German cities, we find that the warp count per cm is 10 to 12 threads in all of them, which explains the common name *Laken*. The width of the materials and the overall warp counts, however, vary from city to city, i.e., Göttingen (in 1476) documents 1740 warp threads to a finished width of 2 3/8 ells, Braunschweig (1535) 1740 warp threads to a finished width of 2 3/4 ells, Lübeck (1553) 1440, 1620 and 1740 warp threads to a finished width of 2 1/2 or 2 3/4 ells. These technical data show that *Laken* are to be classified as medium fine cloths. They are found in large numbers in archaeological excavations dating from the 15th and 16th centuries.

In conclusion we can say that during the 15th and 16th centuries, the 'woolen' weavers in northern German cities produced coarse and medium fine cloths. They were for sale not only in the cities themselves, but also for export. Concerning Göttingen and Braunschweig, an extensive cloth trade has been documented.

The first worsted weavers are documented in northern Germany at the turn of the 16th century (Hamburg 1586). However, they were not successful in making them (Hamburg, Braunschweig) until the 17th century. Consequently, we have to conclude that all the worsteds of the 15th and 16th centuries found in excavations in northern German cities must have been imported.

Pattern Cards from the 17th and 18th Centuries

Pattern cards and pattern books are the most important information sources for the investigation of pre-industrial weaving. They provide us with a good general view of common woolen fabric qualities of the time.

Sometimes cards with only single pieces exist, like the pattern

card of 1774 from Neumünster containing a little tissue sample called *Fries*. It is a carefully finished piece-dyed cloth of medium fine quality. This sample is also remarkable because the finished width is mentioned, namely two *Ellen* which corresponds to a fabric width of about 115 cm. The strongly fulled finishing of this fabric suggests that it had been woven on a broadcloth loom.

Another pattern card dating from 1758 originates also from Neumünster.[5] A Saxon worsted weaver brought it with him. He was instrumental in the founding and running of a manufactory of worsteds between 1758 and 1775. During this time, woolen weaving was the most important business in Neumünster. The main products were *Fries*, *Laken*, *Boy* and blankets. On the pattern card of 1758,14 tissue samples are sewn into the cards. All samples were worsteds: fabrics in tabby called *Camelot* and *Baracan*, in twill, in chevron twill based on a twill 2/2, in lozenge twill, in binding systems put together from warp twill and weft twill and plushes and velvets.

It is not certain, whether all these fabrics were actually woven in Neumünster.[6] We can only say that the treadle looms required for the weaving of all these binding systems were available.

The textile researchers got a lucky break when pattern cards from Lüneburg were found dating from 1678. They contain 236 cloths, worsteds, and mixed weaves. In those days a dispute arose between the tailors and the traders. The tailors feared a curtailment of their privileges through the establishment of more liberal trade statutes. Previously, the tailors had the sole right for selling all types of cloth. Now the traders claimed the right to trade in cloth as well. The tailors' protest, however, was successful: the new statutes desired by the traders were not approved.

The cloth samples in the Lüneburg pattern cards contain almost exclusively fabrics in tabby. The most important quality was *Laken*. Worsteds were produced in tabby, twill, rep and satin. The main qualities were *Sayen* and *Rasch*. They are fabrics made of undyed wools or piece-dyed cloths and worsteds. Some of the fabrics are more or less strongly fulled, while some of them have no finishing at all. Mixed fabrics consisting of wool and linen and/or wool and silk occur rarely. Additionally there are samples of ribbons and damasks–all made of worsted yarns.

18th-century Cloths and Worsteds

Cloth manufacture is well documented from the 18th century onwards in contemporary depictions. The paintings showing the manufacture of Oberleutensdorf in Bohemia dating from 1730 are amongst the most remarkable ones. These pictures show the tools for the production of the most common kinds of cloths. Another prominent example is a painting by an unknown painter from Utrecht in Holland dating from 1760. The picture shows 16 different processes of cloth manufacturing.

The well-known encyclopedias of the 18th century are more informative still. Important for our investigations are the four volumes written by Johann Gottfried Jacobson, S*chauplatz der Zeugmanufakturen in Deutschland* (1773–1776). Apart from the comprehensive representations of linen and silk fabrics, the production of cloths and worsteds is also treated in detail.

The cloths known then in Brandenburg are described in detail. Jacobson distinguishes between cloths and 'cloth-like worsteds'. Cloths are given names according to the degree of fulling that they have been subjected to: *Kerntuch* indicating a completely fulled cloth, *Mitteltuch* indicating a medium degree of fulling and *Ordinäres Tuch* indicating no fulling at all. *Mundierungs*- and super-fine cloths are also mentioned. In Jacobson's opinion, *Fries, Pressboi, Kirsey, Flanell* and *Molton* are to be considered cloth-like worsteds. The number of warp threads, the warp length, the weight of warp and weft, the width and length of the raw and finished cloth and the type of the finishing are frequently mentioned. Using the technical data given in these accounts, one could easily reproduce these fabrics.

The most valued cloths were super-fine cloths made of 2016 warp threads and *Kerntuche* (completely fulled cloths) made of 1728 warp threads, both achieving a finished width of two ells. These cloths were made from good summer wool mixed with winter wool. They were apparently woven in tabby, whilst twills were also found amongst the cloth-like worsteds. Sometimes the twist of the yarn is indicated as well.

Cloths were produced on broadcloth looms. The raw width varies

between 2 ¼ and 3 ½ ells (taking the Prussian ell as a measure, which corresponds to approximately 150 cm to 235 cm) After the fulling and napping, the widest cloths measured approximately 135 cm in width. Some of the cloth-like worsteds were produced as both narrow and wide fabrics.

In one of the four volumes, Jacobson describes the production of different worsteds in detail. He distinguishes between *Zeugmachern* and *Raschmachern* who produced worsteds in tabby or twill made of good country wool, and weavers of *Serge de Rome* and *Serge de Berr*y who produced worsteds made of very fine wool in twill woven on a three-, four- or ten-shaft loom.

Another contemporary report describes not only the production process but also the worsteds produced by *Zeugmachern* and *Raschmachern*. They are subdivided into smooth, twilled, flowered, pulled and cut worsteds. *Rasch*, the worst quality fabric, belongs to the twilled worsteds, while *Serge de Rome* and *Serge de Nimes* belongs to the finer worsteds. They are all well known fabric names during the 17th century, and according to the archaeological findings, also widespread during the 15th and 16th centuries in northern Germany.

Cut worsteds like plushes and velvets are not known from excavations in northern Germany. *Droguet, Floret* and *Damask* are amongst the flowered and pulled worsteds. These large patterned fabrics–excluding *Damask*–do not exist among the textile finds from northern Germany. In Lüneburg, however, a wool damask, dating from the 16th or 17th century, was excavated. It resembles closely the wool damask from the Lüneburg pattern card mentioned before. Of the latter damasks, one is plain black, whereas the other two have a blue warp and a red weft. No dye analysis was made from the excavated damask, so unfortunately it is impossible to decide whether it was monochrome or woven with different dyed yarns.

High-value fabrics like the damask of Lüneburg were rarely found in cesspits. The simple cloths were produced using narrow treadle looms; the large patterned ones used draw looms.

Summary and Conclusion

There are a large number of textile finds excavated in northern

Germany and the adjacent regions, including a lot of woolen fabrics. They provide us with a good view of the fabric qualities from the Bronze and Iron Ages, the Middle Ages and the Early Modern Age.

During the last years, we were able to examine new finds of fabrics as well as loom parts. Accordingly, our knowledge about the development of wool and linen weaving has grown.

The large number of woolen fabrics from the northern German towns and cities illustrate the change in the weaving techniques between the 7th and the 17th centuries. On the other hand, findings of linen fabrics are not numerous enough to justify similar statements.

From the 11th century onwards, the twill derivations herringbone twill, diamond twill and the typical starting borders indicating the use of the warp-weighted loom are missing. While the use of the treadle loom with its tools prevailed more frequently in the cities, the warp-weighted loom continued to be used in the rural regions.

From the 11th until the 13th century, the most important binding system was the twill 2/1 in different qualities. The twill 2/1 was then superseded by the tabby. The northern German fabric finds demonstrate also the technical developments during the 14th century. The woolen fabrics made of worsted yarns became more frequent. In the beginning they were made exclusively of twill 2/2, but during the 15th century the satin binding emerged. They were produced using treadle looms with countermarch. The yarns were spun on the spinning wheel with fly. The ‘woolen’ weavers, using yarn spun on the spindle wheel, used the broadcloth looms. Strongly fulled cloths indicated the increased use of fulling mills.

The cloths and worsteds presented can be documented through a multitude of fabric finds from city excavations dated from the 15th to the 17th century. Written sources have revealed the earlier trade names.

During the Middle Ages the presence of woolen and linen weavers can be shown in almost all of the northern German cities. On the other hand, the activities of worsted weavers can be documented only from the late 16th century in several northern German cities. The question whether woolen fabrics were imported

or domestic can be answered for only a few fabric types. In further investigations, the measurement of the fiber diameters and dye analyses are necessary in order to complement the previous statements.

This contribution demonstrates clearly the difference between the 'cloths' and the 'worsteds'. We do not know whether large-patterned fabrics were produced before the 18th century in northern German cities because they have not yet been found in archaeological excavations.

Notes

1 Tidow 1995b.

2 Tidow 1995b.

3 Tidow 1992; Tidow 2006.

4 Tidow 1992; 1995a; Jordan-Fahrbach, Stührenberg & Tidow 2000.

5 Tidow 2002b.

6 Tidow 2002a.

PART 3 CRAFT AND TECHNOLOGY

17 'Translating' Archaeological Textiles

by Lise Ræder Knudsen

This article will focus on the many cross-disciplinary approaches, mainly involving archaeology, natural sciences and crafts, which have led to new discoveries in the study of archaeological textiles in Northern Europe. One could say that the finds–often tiny brown textile fragments–need a 'translation' before it is possible to understand, for example, what their appearance was when they were in use or how they were made. Sometimes, it is even possible to find answers to the difficult question of why they were made exactly as they were.

In Northern Europe, we are familiar with this way of studying archaeological textiles, but we lack contact with scholars who have knowledge of areas such as gender, society and symbols in the cultures in which the textiles we study were produced. Jointly, we could extend our knowledge much further, bringing pieces of this great puzzle of our history together.

This article will outline some of the most common methods used in natural sciences for studying archaeological textiles and detail briefly some case histories which give an idea of the knowledge that can be obtained by studying the craft of the textiles, working with craftsmen and studying the reconstruction process.

Cross-disciplinary Work on Archaeological Textiles: Archaeology and Natural Science

Dye-stuff Analyses

In pre-historic times, dye-stuffs were used occasionally to give color to garments and other textiles. Different plants, and sometimes dye-stuffs extracted from animals such as insects or snails, were used to color the yarn.

In the natural sciences, various methods are used to detect dye-stuffs in an archaeological context. The most common is UV-visible spectrophotometry, followed by chromatography–for instance, thin layer chromatography, TLC. In recent years, HPLC –High Performance Liquid Chromatography –has also been used. One of the reasons why this method is likely to be preferred in the future is that less original material is needed and less is destroyed during analyses using HPLC.[1]

Microscopy Common in Textile Research

Let us look below at two types of microscopy that permit us to see minute details in textile fibers.

Optical Light Microscopy

Optical light microscopy is a comparatively cheap and easy way to study textile fibers. Even traces of color can sometimes be seen. First, a slide must be prepared and the fiber embedded in resin on a thin glass plate. Then it is possible to study the fiber at different magnifications. Looking at a fiber along its length under an optical microscope will enable one to identify some of the fibers. For instance, cotton has flat, twisted fibers and flax has several knots along the length of the fiber. Some considerations:

–Some optical light microscopes use polarized light, which reveals other details than ordinary light does.[2]

–All hair fibers have special patterns on their surface called cuticular patterns, and each species has a characteristic pattern. These can be used to determine the origin of fibers found in an archaeological context.[3]

–In many cases, additionally, a cross-section of the fibers is made and imbedded in resin. Cross sections of silk have very characteristic triangles, while those of cotton are bean shaped.

In an Iron Age chieftain's grave in southern Germany, at a site called Hochdorf, many fragments of textiles were found. The fiber analyses identified wool from sheep and hemp and, surprisingly, some of the fibers were identified as fine badger under-fur. [4]

Scanning Electron Microscope

The Scanning Electron Microscope (SEM) provides another very useful microscope technique. This equipment is large, expensive and complex, and requires someone with special training to operate it. The Scanning Electron Microscope, however, makes it possible to see very fine details, even molecular structures. In textile research, it can be used to determine, for example, how worn a textile is, or how metal threads are made.

Metal threads are often made by twisting a thin metal strip around a silk core. On a SEM picture it might be possible to see how this thread was made originally. A close-up of a cross section will reveal the shape of the thread's edges. If the edges of the thread are rounded, the metal strip was most likely made by rolling; if the metal strip on the other hand is sharp edged, it was probably made by cutting the strip from a plate. The methods of manufacture in prehistoric times varied according to the area in which the textile was produced, and thus, it is important to note such details.[5]

The Scanning Electron Microscope has even greater potential for textile research. Some SEMs have an EDAX-scanning analytical unit, which allows the identification of inorganic components on a particular area of the surface. This is useful when you want to determine, for instance, the chemical composition of silver or gold threads.

Fig. 17.1: Tablet-woven brocaded silk band from the Danish Viking Age female grave Hvilehøj. Gray-silver corrosion covers the surface of the band and prevents detailed analysis of the method of production. (Photo LRK)

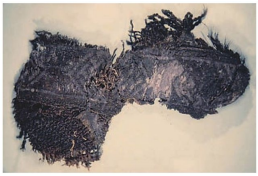


Fig. 17.1 shows a very decomposed tablet-woven silver brocade band from a female Danish Viking Age grave. Gray-silver corrosion covers the surface of the textile and the little motifs of gold thread. An EDAX-Scanning showed that what seemed to be a solid gold thread was in fact very thin gold leaf on a silver base.[6]

Archaeological textile finds are often recognized as merely imprints in bronze or iron corrosion which have preserved the image of little fragments of the textile even though the textile itself has totally disappeared. These textile imprints we call textile pseudomorphs.[7] The Scanning Electron Microscope is also very useful here, as the hollow cavities left from the textile fibers can be sometimes examined, leading up to an identification of the fiber material.[8]

X-ray Pictures

Using X-rays is yet another scientific method by which information can be obtained about hidden structures. Metals, especially, reveal themselves very clearly on X-ray pictures.

Fig. 17.2 shows one of about 12 tiny and fragile fragments of a tablet-woven, silver-brocade band found in a female Danish Viking Age grave at Hvilehøj. Both corroded and non-corroded metal are clearly seen on the X-ray photos.

On the excavation drawing of a similar grave from Hørning, one sees the remains of a woman who was buried in the body of a carriage. Traces of silver brocade bands are visible around the body, and it is possible to see that she probably wore some kind of veil with tablet-woven, silver-brocade borders. The fragments of the borders themselves are only tiny pieces preserved in clumps of soil. From the excavation in the early sixties until recently, the textile fragments had been considered too decomposed for further analyses. However, we had all of the fragments X-rayed and the silver threads, which were often hidden behind soil and silver

corrosion, were clearly seen. In this way at least five different brocade bands were detected. P1, for instance, is a very fine silver brocaded tablet border approximately 1 cm across, and N1 is a part of a broader and coarser silver brocade band, which is at least 5 cm wide.

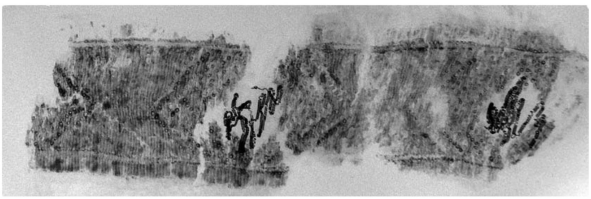


*Fig. 17.2: **X-ray** picture showing the fragments of the Hvilehøj band. The silver thread is clearly seen and the little motif made of gold thread is even sharper. The gold and the silver threads are both made by twisting a thin metal strip around a thread. (X-ray by Birthe Gotlieb, the Danish National Museum)*

By comparing the excavation drawing of the Hørning grave and the X-ray pictures, it was possible to make a good guess at the appearance in parts of the garment in which the Viking woman was buried.[9]

Digital Cameras and Techniques

New digital techniques offer yet another way of working with archaeological textiles, and we are only in the early stages of using this technology for research. By manipulating digital images of textiles it will be possible to enhance certain details. Fig. 17.3 is my own attempt at using a digital camera and Photoshop software. As you can see, it clearly shows that working with digital techniques requires training and experience.

Fig. 17.4 shows a more professional photo made by Steen Hendriksen, of Haderslev Museum in Denmark, a couple of years ago.

This was just a cursory survey of some of the most common scientific methods used in research on archaeological textiles, in order to obtain as much information as possible from the remains of

the textile itself. There is, however, further knowledge bound up in the original finds–the craft used to produce the textile. Modern knowledge of the crafts behind the production of textiles brings another dimension to the science, and together these have enabled research in archaeological textiles to reach a high and ever rising standard. We have seen many cases where solid craftsmanship and years of practical experience in the old textile techniques have led to new insights in research.

Fig. 17.3: My own attempt to enhance details in a digital picture using PhotoShop software. (Photo LRK)

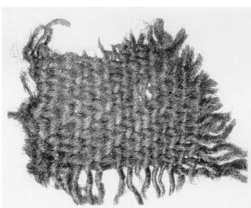


Fig. 17.4: Digital photo created using PhotoDraw software. Making a good digital picture of textiles requires skill and much experience. (Photo Steen Hendriksen, Haderslev Museum, Denmark)

Cross-disciplinary Work between Archaeology and Crafts

In Denmark, the rediscovery of ancient textile crafts and reconstruction work take place primarily within the framework of open-air sites built as ancient villages, where tourists can see reconstructions of houses and crafts of ancient periods. Research into practical crafts has to survive by letting the ‘experimental archaeologists’ pass knowledge onto tourists. Obviously, it can be difficult under these circumstances to conduct research work in the most desirable way.

Some experimentalists working on the reconstruction of ancient crafts are self-employed and do this *con amore*, while others –like myself–do this as a sideline to their job, which may be in conservation, archaeology or teaching. Only by stimulating and maintaining public interest in ancient crafts rather than, as would be ideal, being involved in pure research, have Danish experimentalists gained a solid base of more than 30 years of experience in the reconstruction of ancient textiles.

I have listed here some examples from my own personal experience to show how a solid knowledge of the craft production has yielded new information. Knowledge of crafts and reconstruction work can help to determine the original weaving (production) methods and to eliminate unlikely weaving methods. Solutions to the question of the purpose of unknown tools may also be found. It can help to indicate the level of craftsmanship needed to produce a certain textile and it can enable one to have some idea of the time taken to produce a textile, an absolute necessity when making reproductions for exhibition purposes.

Determining Original Weaving Methods and Making Reproductions for Exhibitions

In Denmark, Norway and Northern Germany, the remains of several cloaks from the Iron Age have been preserved. Some of these cloaks have broad tablet-woven borders attached to the edges in an invisible way.

Hitherto, it was believed that the cloak fabric and the tablet border were woven at the same time, with the tablets hanging by the sides of the warp-weighted loom. This weaving process was tried, but was found to be difficult and time-consuming: it took two skilled weavers a year to make a complete reconstruction.[10]

Fragments of a cloak with broad tablet-woven borders were found in an Iron Age grave near Vrangstrup in Denmark (Fig. 17.5). This find is very interesting because the broad tablet-woven border is held together by only a few weft threads. Most of the weft was presumably made of linen thread and so has disappeared totally due to decomposition, but what remains of the tablet border are parallel strings. The border is made of wool, which is more resistant to decomposition than vegetable fiber. A closer inspection of the edge

of the fabric and tablet border reveals little eyelets in the weft of the cloak fabric. The only way a thread course like this could have been worked would have been if the cloak fabric had been woven on a loom first. A tablet border would have been attached to the cloak fabric later, using the loops of threads at the selvedge to link with the weft of the border. Thus, the joint between the weft of the cloak fabric and the weft of the border would have been totally hidden inside the tablet weave (Fig. 17.6). Noticing small details like this is important.

Fig. 17.5: Broad tablet-woven border from Vrangstrup near Randers in Denmark (375 AD). The border is attached to the cloak fabric in an invisible way. Most of the weft of the border was presumably made of vegetable fiber, which has now disappeared. The warp threads of the tablet weave are held together by only a few weft threads, and so it is possible to see that the threads of the cloak fabric do not continue through the tablet border. (Photo LRK)

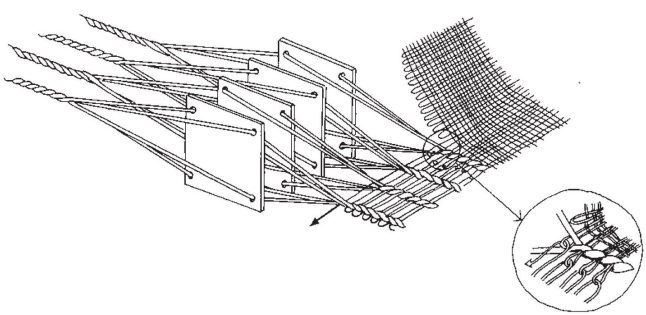


Fig. 17.6: Drawing of the method of production of the border of the Vrangstrup cloak. The cloak fabric is woven first and the border woven afterwards. (Drawing: Michael Højlund Rasmussen)

Anna Nørgård, who is a hand weaver specializing in the reconstruction of ancient garments, was working on the reconstruction of a cloak for the museum where I was employed at that time. As is so often the case, the museum was short of money. A copy of an Iron Age cloak with a tablet-woven border was required for an exhibition, but we could not afford to have two weavers working on this project for a year. Anna suggested that she could weave the cloak fabric first and then weave the tablet border onto the selvedge using the yarn eyelets. Her knowledge of weaving methods gave me insight into how the thread lines had been worked in the find, and in this way the original method of production was discovered.[11]

Making Reconstructions

Making reconstructions is the greatest 'translation' of an archaeological textile. With the help of new technology, scientific equipment and the latest knowledge, a fabric can sometimes be reconstructed from the dark and insignificant fragments of a find, showing how the original textile might have looked. Reconstructions are popular nowadays and a very effective way of passing on knowledge about the appearance of people in ancient times. And as very few original textiles have been preserved, this is the best means museums have of developing that knowledge. But one must be aware that reconstructions are 'children of their time': we always look at other periods through the glasses of our own age.

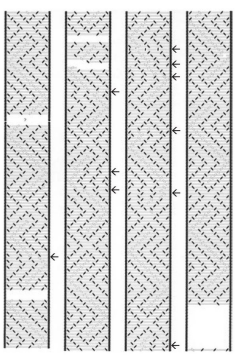
During the analyses of the textile finds and the reconstruction process, it is sometimes possible to get a glimpse of the original weaver's way of thinking, and even ideas of why the textile was made in exactly the way it was. When we reach these levels of understanding, the work becomes more exciting and the need for further cooperation among different disciplines in our field is obvious.[12]

Determining Unlikely Weaving Methods

Another case detailed below shows how practical skills and knowledge about the original working methods revealed information hidden in the archaeological textile.

A tablet-woven brocade band from the Middle Ages was found in Plessenstrasse in Schleswig, Northern Germany.[13] The material was red and white silk, and the brocade weft was of thin gold with a silk core. The pattern was simple and repeated along the preserved 40 cm band. Even though the band was in very good condition, the changes in color made it difficult to see the pattern. Fig. 17.7 shows an analytical drawing of about half the band and the arrows indicate weaving defects in the otherwise regular pattern. The interesting thing is that these defects occurred suddenly across the motif in the same way.

Fig. 17.7: Analysis drawing of a tablet-woven brocade border from Plessenstrasse in Schleswig in Germany. The arrows indicate weaving defects. Notice that the defects occur suddenly in relation to the pattern of the border. (Drawing LRK)



I have had personal experience of creating similar weaving defects, when I wove a band using a written pattern and, by mistake, followed the wrong line of the pattern. Although I have seen many weaving defects in pre-historic tablet weaving, those defects were quite clearly due to mistakes in the way in which the weaver *looked at the band.* The brocade band from Plessenstrasse, however, has a completely different type of weaving defect–which could only have come about because the band had been woven using a written pattern and the weaver had made a mistake in

following the instructions.[14]

Determining the Purpose of Tools

In the famous Viking Age burial, Oseberg, in Norway, a complete tablet loom was found. Although the excavation took place some 100 years ago and the loom was taken apart because it could not be preserved as it was, we are fortunate in having a photo from the excavation.[15]

The tablets, as seen in Fig. 17.8, were in an exhibition some years ago. Most of them are little wooden square plates with a hole in each corner. Some of the tablets, however, have not just four holes, but eight holes. My guess is that the eight-holed tablets might have been used for making brocade bands and making the work easier when used for a part of the edges.

Normally the pattern of tablet-woven brocade bands consists of a central motif and stave borders, typically along the edge. In these stave borders, the brocade thread always passes over the threads from the same tablets. It is necessary to look more closely at this type of weaving method to understand what is involved.

The ordinary weft thread is passed through the shed. Then the warp threads are picked up according to the pattern, and the golden brocade weft is passed through the shed (Fig. 17.9). Every time one reaches the edge, one has to move the shuttle up and down to make the stave border. This is easier using the eight-hole tablets: by placing the threads in the inner holes, one can simply pass the shuttle directly through the stave border, and one has only then to pick up the warp threads of the central pattern. (Fig. 17.10). When both the silk weft and the brocade weft are passed through the shed, the tablets are twisted, and one can start from the beginning again.

Fig. 17.8: Some of the tablets found in the Oseberg burial. Most of the tablets are ordinary 4-hole tablets but some have 8 holes

(Photo LRK)

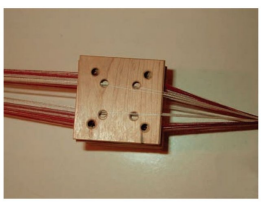


Fig. 17.9 : Most of the preserved brocaded tablet borders have stave borders along the edges. These stave borders were made by letting the brocade thread pass over and under the same threads of the edge. By warping the inner 4 holes of the 8 holes in the tablets, it is easier to make the stave border (Photo LRK)

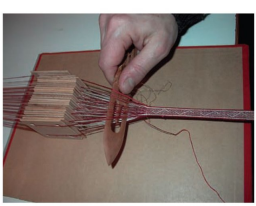


Fig. 17.10 : The pattern of the brocade band emerges when picking up different warp threads. Making a stave border requires the warp threads belonging to the same tablets to be pushed down for every weft thread. Using the inner 4 holes of 8-hole tablets for these, makes the work quicker and easier. (Photo LRK)

As this case history shows, experience in practical weaving techniques adds considerably to one's understanding of the use of tools.

The Demand for Further Cross-Disciplinary Work

The last case history is about an ongoing project on the analysis and conservation of Etruscan textiles from Verucchio, near Rimini in Italy. In the summer of 2002, Dr. Patrizia von Eles published a report on the findings from one of the richest graves from about 725–700 BC. Dr. Annemarie Stauffer of the School of Conservation in Cologne, Germany, and I have written the chapters on textiles, tablet weavings and some of the textile tools.[16]

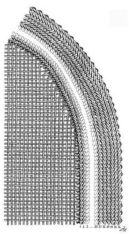


Fig. 17.11 : Connection of the tablet border and the cloak fabric of one of the Etruscan cloaks from Verucchio (grave 89). The cloak fabric is woven first, and afterwards, the fringes of the cloak fabric are used as weft thread in a tablet border. (Drawing LRK)

In grave 89, two crescent-shaped cloaks and a garment of unknown purpose were found. The fabric is 2/2 twill with a spinning pattern, and the cloaks have tablet-woven borders along the edges. A drawing of the tablet border (Fig. 17.11) shows its attachment to the cloak. The dye-stuff analyses suggested that the cloak was dyed with some kind of madder, one thread system being a slightly different color from the other, and that the border was dyed with both madder and indigo (Fig. 17.12). Scientific analyses have given us some idea of the original colors of the cloak, and knowledge and experience of the weaving process have helped to determine the weaving method used. However, there is still much information hidden in the material from the graves in Verucchio.

Fig. 17.12 : The pattern of the border on the cloak from Verucchio (Drawing LRK)

Fig. 17.13: The carvings on the wooden throne from Verucchio, Grave 89. This extract shows the weaving scenes on the back of the throne. (Drawing: Patrizia von Eles)

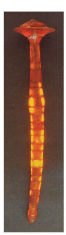


Fig. 17.14: Etruscan amber spindle or distaff from Grave 43, Verucchio. (Photo: Sergio Orselli, Moreno Fiorentini)

The most famous object found in the grave is, without doubt, the wooden throne. It was made out of a tree trunk and decorated with bronze nails and carvings. Processions, wagons, houses, weaving scenes and many other motifs are depicted on the inner side of the back of the chair. In the upper central part of the motifs, one can

see two looms (Fig. 17.13), where women, with long hair, sit on chairs placed high on tables, with footstools. They are working on something–possibly borders–and some triangular shapes are seen hanging from the borders, which could be types of loom-weights.

The motifs on the chair raise a number of questions. Why are the weaving scenes so important that they are shown on the throne? Why does the zigzag pattern found on the edges of the cloak appear in so many different places in the grave? Why is the woman in the middle to the left placed much higher than the others? And what exactly are they doing? How does the loom work, and exactly what are the women working on? On the basis of our past experience, we are fairly well qualified to deal with the questions of 'what' and 'how', but the question of 'why' is rarely touched upon in most ancient textile research.

In the many Etruscan burials in Verucchio, various weaving tools have been found. Fig. 17.14 shows a spindle, or possibly a distaff, made of amber derived from the Baltic area. It is beautiful, but it could not have served as a spindle, as it is too lightweight. If it had been used as a distaff, the fibers would have covered the amber; moreover, it appears to be too fragile to have been used in this way. Why did the Etruscans make a spindle like this, when it would have been impossible to use?

Conclusion

In this paper I have given a short survey of the scientific methods used in the service of textile research and examples of how experience in ancient crafts extends our knowledge about production methods. But, in my opinion, we still have much to learn about why textiles were made exactly as they were. The only way to obtain this knowledge is to extend cross-disciplinary work–which was the intention of this conference on ancient textiles.

The spindle from a female grave in Verucchio in Italy could well serve as a symbol of the conference. Scientific analyses have revealed that the amber originally came from the area around the Baltic Sea, just outside Falsterbo in Sweden perhaps, where the first part of the symposium took place. Our knowledge of spinning tells us that the spindle or distaff is useless as a tool. As for its symbolic values, the answers are still missing, and only extensive cross-

disciplinary efforts may provide them.

Acknowledgements

I would like to thank the Danish National Museum for giving me the opportunity to study the finds from Vrangstrup, Hvilehøj and Hørning and especially the conservator, Birthe Gotlieb, of the National Museum, for taking all the X-rays of the finds. I am grateful to Steen Hendriksen, Haderslev Museum, and Lene Frandsen, Varde Museum, for letting me use the digital photograph of the archaeological textiles from Lønne Hede. My thanks also go to the weaver Anna Nørgård, to the conservator Irene Skals, and to archaeologist Anne Hedeager Krag, for discussions and suggestions concerning the interpretation of the three finds. I sincerely thank Dr. Ingrid Ulbricht and the conservator, Heide Marie Farke, both of *Schloss Gottorf*, Schleswig, Germany, for letting me use the material from Plessenstrasse; and Dr. Patrizia von Eles, *Soprintendenza Archeologica dell'Emilia Romagna*, Italy, and Prof. Annemarie Stauffer, *Fachhochschule* Köln, Germany, for discussions and teamwork on the material from Verucchio. Finally, I am very grateful to Madeleine Hanson-Kahn for language corrections and Michael Højlund Rasmussen for corrections and drawings.

Notes

1 Walton Rogers 1999.

2 Greaves & Saville 1995.

3 Teerink 1991.

4 Banck-Burgess 1999.

5 Østergård 1991; Geijer 1994, 21.

6 Hedeager & Ræder Knudsen 1999.

7 See Unruh, this volume.

8 Fisher 1994.

9 Hedeager & Ræder Knudsen 1999.

10 Schlabow 1965, 54.

11 Ræder Knudsen 1998, 79–84.

12 Bender Jørgensen 1992a; 1993.

13 Plessenstr. 83/3 No. 80a and b, Archaeologische Landesmuseum, *Schloss Gottorf*.

14 Ræder Knudsen 2001, Ræder Knudsen 2004.

15 Collingwood 1982, 16.

16 von Eles 2002; Stauffer 2002; Ræder Knudsen 2002. See also Gleba, this volume.

18 The Use of Wool for the Production of Strings, Ropes, Braided Mats, and Similar Fabrics

by Hartmut Waetzoldt

In Mesopotamia, modern Iraq, around 2000 BC, there were large textile mills where thousands of female weavers and children produced large quantities of textiles, both for local use and for export. In this paper another professional branch, the so-called tug2-du8 workers, will be discussed. They used mainly wool and goat hair to produce strings, ropes, hawsers, straps and many other kinds of braided materials. These served, for instance, as seats for chairs or as webbings for bedframes, while others were used to transport (fragile) ceramic containers. By comparison with the terracotta models of beds and stools/chairs, it is shown how different the patterns of braided mats were and how they were fixed to the frames of the beds and chairs.

These craftsmen also produced large braided mats of goat-hair for river boats. Since the size of these products was exactly proportional to the size and load capacity of boats, they might have been sails. In any case, these braided mats vary from 9 m long and 5.5 m wide for larger boats, to only 5 m long and 3 m wide for smaller boats.

More than thirty years ago, in my PhD dissertation, I discussed all aspects of textile mills and the work of the female weavers in Mesopotamia.[1] Around the year 2000 BC, there were many large weaving mills in many cities. Thousands of textile products of various qualities and styles were made for domestic consumption and for export. These mills were staffed by 1,000–5,000 (adult)

female weavers and up to 1,000 children in the largest of the textile mills. They were usually supervised by men. In this paper I will concentrate on a specific occupational specialty concerning Mesopotamian workers of wool and goat hair: the rope-makers, and men who produced plaited straps and webbings. In Sumerian they are called tug$_2$-du$_8$. These craftspeople and their products have been given only cursory treatment in previous scholarship, including specialized handbooks concerning the methods of the textile industry. My research is based on cuneiform texts and archaeological finds.

In the specialist literature, the name of the profession tug$_2$-du$_8$ is translated in very different ways, such as, 'fuller', 'upholsterer', 'cord-maker', 'preparer of felts', 'harness-maker' and even 'weaver'. Piotr Steinkeller, in an article about this profession, thinks that these men were weavers, cord makers, and felters all in one person.[2] I think this is impossible, and I hope to show in this paper that these craftspeople made strings, ropes, different types of plaited straps, mats and similar products. In this paper I will concentrate on three segments of the production of the tug$_2$-du$_8$: first, yarns, strings and ropes; second, a fabric called ša$_3$-tuku $_5$ for beds; and third, an expression that probably designates sails of boats.

Ropes and Strings

According to the ancient texts, strings, cords and ropes are normally made out of goat hair and more seldom, of sheep wool. Also used are different reeds and other plant materials. Methods of rope manufacture consisted of spinning or twisting separate fibers into a yarn, twisting the yarn into strands, and finally twisting the strands into a rope. Ropes of reeds (between 8 and 51 m long) were produced by basket weavers.[3] The ropes of goat-hair were of similar length, the longest (recorded) rope being 90 m. In order to produce thicker ropes (eš$_2$-mah) 30 m long, up to 8 kg of goat hair were needed.[4] The quantity of goat hair required was dependent on the length and thickness of the rope. It took up to 9 days for a tug$_2$-du$_8$ worker to produce them.[5] Sometimes different colors of wool were used to make multicolored bands, cords or strings.[6] The tug$_2$-du$_8$ also produced threads and yarns from goat hair.

It is important to keep in mind that all objects were produced for specific purposes. In the past, they did not make long strings or ropes and then cut them into pieces as we do today. For example, the lash of a whip, ropes for towing boats, or ropes to yoke oxen to plows were manufactured specifically for these purposes. Specialists also made thinner ropes for things like dog leashes or reins. We have accounts of how much thread was needed for these specialized products. A leather waterskin, for example, used between 21 and 42 g of thread. For the throne of a goddess, more than one kg of thread was required in addition to 2 sheepskins and 250 g of glue. For the bed of the highest god of the pantheon, 3.37 kg of thread were needed, along with 23 sheepskins and 4 goatskins.[7]

Beds, Stools and Chairs

We find quite often in the texts a textile called ša$_3$-tuku$_5$ used in connection with beds. This term is translated often as 'cushion' or 'mattress' and once as 'plaited mattress' (in German: '*seilgeflochtene Matratze*'). This last translation conflicts with P. Steinkeller's definition of ša$_3$-tuku$_5$ 'as a sheet of felt serving as bed padding, which, even though it probably was not stuffed, can for all practical purposes be translated as "mattress".'[8] If we look at the many terracotta models of beds that were found during archaeological excavations, the meaning of ša$_3$-tuku$_5$ is obvious. The bed models show neither cushions nor mattresses, even when a woman or a couple is lying on them (cf. Figs. 18.12–18.13). The figures are always lying directly on a kind of fabric, which is attached in different ways onto the bedframe. One can find these types of beds even today in the Near East, in Iran or India.

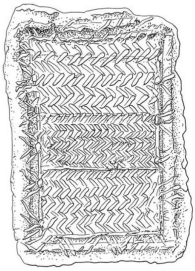


Fig. 18.1: Terracotta model of a bed from Ur (Mesopotamia).

According to the texts, ša$_3$-tuku$_5$'s were made out of wool and goat hair. For finer products, the wool was combed and designated third quality. Between 2.5 and 4.3 kg of wool were necessary to make them; the average weight is 3.2 kg.[9] When leather consisting of one or two sheep hides was used, less wool was necessary for each ša$_3$-tuku$_5$.[10] This means that the leather was not used to cover the plaited fabric, but was cut into thin straps which were probably used to attach the plaited fabric onto the bedframe or onto the crossbeam.[11] Sometimes the webbings of the beds are treated with 500 or 600 g of a mineral earth called in Sumerian 'white earth' (im-babbar), which may be gypsum.[12] According to a Neo-Babylonian text the webbing of a bed is made out of red dyed wool.[13]

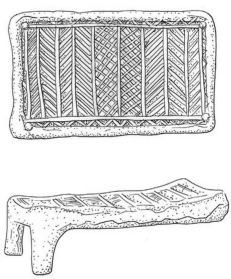


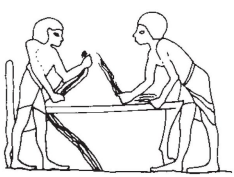
Fig. 18.2: Bed model from Tepe Gawra (Mesopotamia).

Fig. 18.3 : Reconstruction of a bed in an Old Babylonian grave from Baġuz (Syria).

An unpublished text provides the measurements of fabrics called ^{túg}ša$_3$-ga-du$_3$[14] which are used in the same way as the ša$_3$-tuku$_5$'s. The measurements are relatively small, 1.6 m or 1.75 m long and

66 or 75 cm wide.[15] The smallness of the beds in Mesopotamia is best illustrated by a Sumerian proverb: 'The strongest one cannot stretch out in bed.'[16] But in Syria, Palestine and Egypt, the beds have comparable measurements, and some are even smaller. Normally the bedframes in Egypt are between 1.5 and 1.8 m long and between 65 and 85 cm wide.[17] According to the text mentioned above, one plaited strap was needed for each ša$_3$-tuku$_5$. The length of these straps varied between 27 and 9 m and the width between 2.5 cm and 5 cm.[18] In order to understand what these straps were used for, a glance at the bed models is helpful. One can see that on some of the beds the webbed cloth is fixed to the frame of the bed with cords, ropes[19] or leather straps (Figs. 18.1–18.2). This is the more expensive variety, but it had many advantages. The webbed mat could be produced and stored separately, and if the frame of a bed broke into pieces, the latter could be taken off and re-used for another bed. This is clearly proved by the ancient texts.[20]

Fig. 18.4 : Men weaving cord across a bedframe from a relief in tomb 112 at Thebes (Egypt).



We can observe the cheaper variety from the reconstruction of a bed found during excavations at Baġuz. One can see this also on the terracotta bed models mentioned earlier (Figs. 18.3, 18.6b, d, e, f, 18.13). The strings are wrapped around the frame and woven to form a matting.[21] These types of beds were found also in Egypt. On a relief of an Egyptian grave at Thebes, two craftsmen are plaiting string onto a bedframe to form webbing (Fig. 18. 4) .[22]

In Mesopotamia and in Egypt we also find the same plaiting pattern (Figs. 18.5, 18.6a). In both cases, the strings are wrapped around the pole before being plaited in groups of four in one-over/ one-under band weave. In Mesopotamia nearly every bed looked different, although on one bed model and one stool model we find a very similar pattern. The bed models show many different patterns:

for example, herringbone pattern or zigzag,[23] while others have patterns like twill-binding and diagonal weave (Figs. 18.1–18.2, 18.6b-h, 18.10).[24] The legs of beds or chairs are also very similar in Mesopotamia and in Egypt (Fig. 18.7). The texts from Mesopotamia mention often that legs of beds or chairs are formed like bull's legs, for example, the throne of King Urnamma (2111–2094 BC) has 'bull' legs.[25]

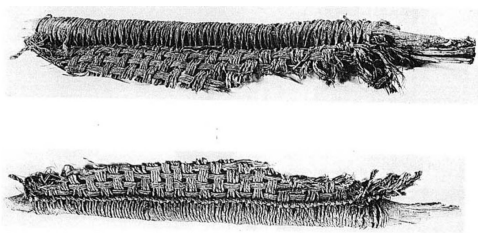


Fig. 18.5 : Bed pole with webbing from Tarkhan (Egypt).

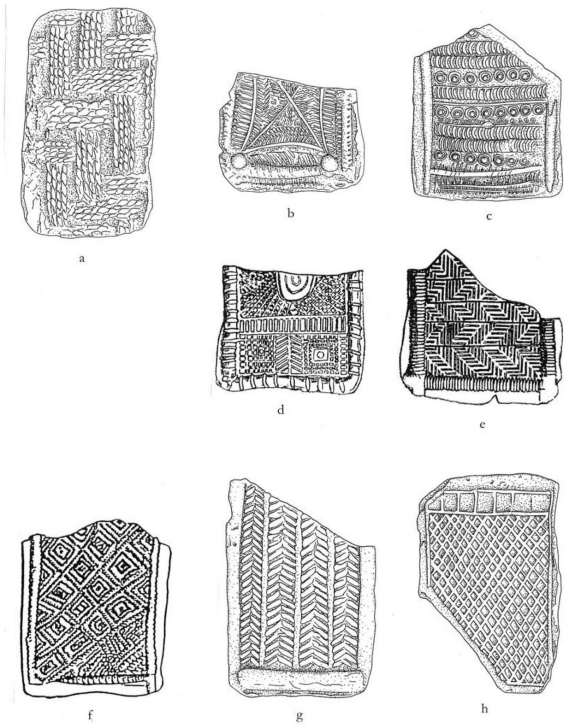


Fig. 18.6: Different patterns on bed models from Kiš, Nippur, Susa, Tell ed-Dēr, Tell Rimah and Uruk.

Fig. 18.7 : Bedframe from Tarkhan (Egypt) with webbing slots and bull-legs.

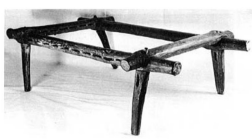


Fig. 18.8 : Wooden stool with webbing slots from Egypt.

Fig. 18.9 : Terracotta model of a bed from Ur (Neo-Sumerian or Old Babylonian).

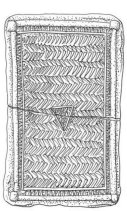


Fig. 18.10 : Terracotta model of a bed with two rosettes from Uruk (Old Babylonian).

Fig. 18.11 : Terracotta model of a bed from Nippur (Neo-Sumerian).

Fig. 18.12 : Terracotta model of a bed from Neribtum with reclining nude female (Early Old Babylonian).

Fig. 18.13 : Terracotta model of a bed with erotic scene (provenience unknown, Old Babylonian?)

Fig. 18.14 : Terracotta model of a stool from Girsu (Neo-Sumerian or Old Babylonian).

Fig. 18.15 : Terracotta model of a stool from Susa (Old Elamite).

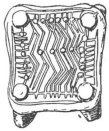


Fig. 18.16 : Terracotta model of a chair from Uruk (Old Babylonian).

Fig. 18.17 : Terracotta model of a chair from Ur-Diqdiqqe (Old Babylonian?).

On some beds, the ropes and straps are not wrapped around the poles of the bedframe, but fixed in another way, which is also known from Egypt. In some bedframes there are slots or holes in the poles (Fig. 18.7, cf. the stool Fig. 18.8).[26] The ropes or straps are pulled through those holes. On the bed models, the slots are not visible, for they are too small, but since there are no ropes or straps wrapped around the bedframe, I see no other possibility than that these are pulled through the holes or slots (Figs. 18.2, 18.6g, h, 18.9–18.11).[27] Sometimes we find a crossbeam at the lower part of the bed where the plaited cloth was fixed (Figs. 18.12–18.13). I think that this crossbeam was used to stretch the webbing.[28]

The seats of the terracotta stool and chair models show very similar patterns to the plaited bed surfaces (Figs. 18.14–18.17).[29] However, in the texts of that period, the word ša$_3$-tuku$_5$ does not appear in connection with chairs. This may be simply an accident of discovery, for in texts of a later period we do find similar terms. In

those texts, in addition to wool, flax and hides were used to produce the seats for stools and chairs.[30] On most depictions of stools and chairs they are seen from the side. Therefore, we learn nothing about the different types of seats. From Egypt we have several examples of stools with plaited seats (Figs. 18.18–18.19), and in Mesopotamia the stools and chairs had such webbings, as well (Figs. 18.14–18.17).[31]

Fig. 18.18: Stool from Thebes (Egypt) with plaited seat (coated with plaster).

In cuneiform texts from around 2000 BC, we find the expression tug_2-du_8-a for webbed cloth. It was used for shoes, sandals and the seats of stools and chairs. Normally this fabric, when used for ordinary chairs, weighed between 800 and 1000 g of wool, but for women's chair only 370 g were needed.[32] That is to say, this fabric must have been very heavy and thick, for the seat of a chair is normally only about 45 or 50 cm square. Therefore, I think the tug_2-du_8-a fabric is densely plaited. This interpretation agrees with the use of the tug_2-du_8-a fabric in shoes or sandals probably as a sole or insole.[33]

Sails(?)

In the unpublished text cited earlier, there is a description of a large textile called $KIRI_2$ (Fig. 18.24, Nos. 8–12). It was used for boats and always made of goat hair. In our dictionaries the Akkadian equivalent of this word is translated as 'rope',[34] but this is certainly wrong, since this text offers, for the first time, the measurements of these products. The largest one is 9 m long and 5.5 m wide, made for a boat of 11.7 tons (No. 8). It weighs nearly 40 kg. The smallest one, for a boat of 3.9 tons, is 5 m long and 3 m wide and has a weight of 10.1 kg (No. 12). The relationship between length and

width is always 1:1.6 to 1:1.7. The measurements of the two smallest $KIRI_2$'s (Fig. 18.24, Nos. 11–12) are identical, but their weights differ considerably. For the larger boat of 5.8 tons it is 14.4 kg (No. 11) and for the smaller boat of 3.9 tons, only 10.1 kg. This means that a square meter weighs either 960 g or 673 g, or, in other words, the $KIRI_2$ for the smaller boat is much thinner than the one for the larger boat. These weights are normal for wool sails in Scandinavia, as Susan Möller-Wiering and others have shown.[35] We have no depictions of cargo boats or other boats with sails in Mesopotamia from the time around 2000 BC and even in the 2nd millennium BC, there is none. Therefore it is difficult to fix the meaning of this word $KIRI_2$.

Fig. 18.19: Stool from Egypt with double braid webbing.

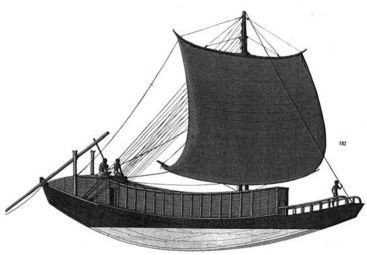


Fig. 18.20 : Reconstruction of a cargo vessel (6th Dynasty, Egypt).

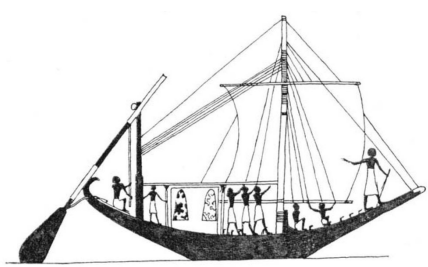


Fig. 18.21 : Painting of a ship under sail from the tomb of Amenemhet in Beni Hasan (12th Dynasty, Egypt).

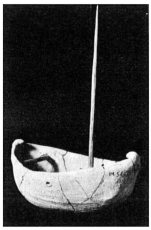


Fig. 18.22 : Model of a sailing boat from Eridu (first half of the 4th millennium BC).

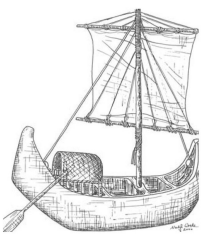


Fig. 18.23 : Reconstruction of a Neo-Babylonian clay model from Uruk.

Egyptian paintings and reliefs from the Middle Kingdom onward depict the boats with rectangular-shaped sails (Figs. 18.20–18.21); earlier ships have trapezoidal sails. From the 1st millennium BC, several illustrations of large sailing vessels from the Mediterranean are known. They all show war galleys. Their sails are never seen but brailed up. Since the yard is shown horizontally and always fixed to the mast in its middle, we can assume that these sails were rectangular.[36] The same we may suppose for Mesopotamia. We have so far several clay models of small sailing boats, but no illustration of a boat under sail (Figs. 18.22–18.23). I am convinced that these KIRI$_2$'s are sails but cannot prove it with certainty. The manufacture of one KIRI$_2$ took a man between 40 and 171 days.[37] In the texts we do not find any indication whether these KIRI$_2$'s were woven or webbed. But since it is a product of the tug$_2$-du$_8$'s, in my opinion they were webbed.

Ropes for Boats

	object	material	max. load of the boat	length	weight of object	number of days to produce
1	1 rope	goat hair	ca. 11.7 tons (cf. no. 8)	21 m	8.08 kg	8.8
2	1 rope	goat hair	ca. 5.85 tons (cf. no. 11)	[21[7] m]	2.5[7] kg	2

Webbed Mats for Beds (= a) and Straps for Attaching the Webbing to the Bedframe (= b)

	object	material	length	width	weight of object	white,earth'	number of days to produce
3a	1 webbed mat	combed wool 3rd quality	1.66 m	0.75 m	2.525 kg	0.505 kg	67[7] days
b	1 long plaited band	combed wool 3rd quality	27 m	4.99 cm	1.515 kg	295 kg	40 days
4a	1 webbed mat	combed wool 3rd quality	1.75 m	0.75[7] m	2.02 kg	0.639 kg	56 2/3 days
b	1 long plaited band	combed wool 3rd quality	9 m	4.16 cm	1.262 kg	0.252 kg	32 1/3 days
5a	1 webbed mat	wool of 5th quality	1.75 m	0.75 m	2.02 kg	0.639 kg	not preserved
b	1 long plaited band	wool of 5th quality	10 m	4.16 cm	1.01 kg	0.202 kg	11 1/6 days
6a	1 webbed mat	wool of 5th quality	1.66 m	0.66 m	1.767 kg	0.353 kg	23 ¼ days
b	1 long plaited band	wool of 5th quality	9.166 m	4.16 cm	not preserved	0.202 kg	11 days
7a	1 webbed mat	wool from dead animals	1.50 m	0.66 m	1.767 kg	0.353 kg	22[9] days
b	1 long plaited band	wool from dead animals	9 m	2.5[7] cm	not preserved	not preserved	not preserved

Sails[7] (KIRI$_2$)

	object	material[i]	max. load of the boats	width/ length	height/ width	square meters	relation-ship width to height[ii]	weight of object	weight[iii] per m²	number of days to produce
8	1 KIRI$_2$	goat hair	ca. 11.7 tons	9 m	5.5 m	29.5 m²	1.63 : 1	39.71 kg	1.288 kg	171
9	1 KIRI$_2$	goat hair	ca. 7.8 tons	6 m	3.5 m	21 m²	1.71 : 1	25.25 kg	1.202 kg	95
10	1 KIRI$_2$	goat hair	not preserved	not pre-served	not pre-served	---	---	not pre-served	---	not pre-served
11	1 KIRI$_2$	goat hair	ca. 5.85 tons	5 m	3 m	15 m²	1.66 : 1	14.4 kg	0.960 kg	50
12	1 KIRI$_2$	goat hair	ca. 3.9 tons	5 m	3 m	15 m²	1.66 : 1	10.1 kg	0.673 kg	40

[i] Also goat hair for the sail[7] (KIRI$_2$) in Fish 1958, 86 r. II 16 (classified as 'old').
[ii] Möller-Wiering 2002, 81, larger sail c. 6.6 × 12.8 m = relation 1:1.95; smaller sail 4.7 × 8.2 m = relation 1:1.74; but Andersen 1995, 264,c 6.6 × 7 m = relation 1:1.06.
[iii] Andersen 1995, 259–261; Möller-Wiering 2002, 26, the weight of woolen sails of c. 20 m² is c. 500 g/m²; that of larger sails of 50–130 m² = 950-1000 g/m².

Fig. 18.24: Table for ropes, webbed mats and straps, and sails.

Notes

The illustrations Nos. 18.1, 18.2, 18.6, 18.9, 18.10, 18.1, 18.12, 18.13, 18.14, 18.16 and 18.17 were drawn by Dr. Nadja Wrede, Heidelberg. I am extremely grateful to her for this skillful work on which she devoted a great deal of time and effort.

1 Waetzoldt 1972.

2 Archi 1987, 117 'preparer of felts'; Civil 1994, 73:20 'felt and strap maker'; Falkenstein 1957, 167 'Polsterer'; Lafont 1990, 152

‘tisserand’; Sallaberger 1996, 4 ‘Walker’; Selz 1989, 90 ‘Filzhersteller, Seiler’; Sommerfeld 1999, 150 ‘Walker’; Steinkeller 1980, 93; Van de Mieroop 1987, 35f. ‘felter’; Vanstiphout 1984, 245 n. 23 ‘harness-maker’. Stol 2003, 641 mentions the following translations: ‘tapissier’ and ‘cordier-corroyeur (?)’.

3 De Genouillac 1922, 6036 VIII 14f., 38, XV 36ff., 6049 I 15; Waetzoldt 1992, 133.

4 Fish 1958, 90 BM 105417:3 90 m; Myhrman 1910 Nos. 49, 50, 52, 53, 63, 65 30 and 33 m; de Genouillac 1912, 6414:13 2.4 kg; Nikolsky 1915, 506:1–2 7.83 kg; Waetzoldt 1972 No. 50 4.4 kg; Van de Mieroop 1987, 36: 24 m long with a weight of 15 kg.

5 See Fig. 18.24, Nos. 1–2.

6 Dogleashes: Alster 1997, 129; Koslova 2000, No. 41 r. III 5, 269 r. I 22, 288 r. I 8, 17; reins: Koslova 2000, No. 25:1 252 g; de Genouillac 1912, 6414:6f. 328 g.

7 Threads for waterskins: Crawford 1954, 327:11f., 395:39f., 415:16f., 424:10f., 425:14f., 435:8f.; throne of the goddess: 378:4–6 and bed of a god: 254:1–4 + 255:1–6 + 303:1–11.

8 Edzard 1968, No. 64:1 ‘Kissen’; Van de Mieroop 1987, 151 ‘mattress’; Sallaberger 1999, 246 ‘seilgeflochtene Bettmatratzen’; Steinkeller 1980, 80.

9 Steinkeller 1980, 81f. a-f, m (weight only 1.6 kg); Yıldız & Gomi 1993, 2214; Sigrist 2000, 177. The wool which was plucked from sheep with good wool, for example the fat-tailed sheep, was classified into five qualities.

10 Crawford 1954, 348:4–8, 351:1–6, 417:4–5; Foster & Van de Mieroop 1983, 57, 8:4–6; Grégoire 1996, 1932–274:6–16.

11 See below, with note 28.

12 Grégoire 1996, 1932–274:6 + 10 and an unpublished text. In Egypt there are beds where the webbing and the frame are painted white (Baker 1966, 105f., Fig. 139 = Killen 1980, 32 and Pl. 39).

13 Jursa 2003, 233f.

14 It is uncertain whether this reading of the cuneiform signs in this text is correct, since the signs GA.DU$_3$ sometimes do not look so much different at times from the sign TAG = tuku$_5$.

15 However, in Syria, Palestine and Egypt today, beds have such measurements, some even smaller. See Fig. 18.24, Nos. 3a–7a.

16 Alster 1997 SP 17 sec. B2.

17 Parr 1996, 43–47; Killen 1980, 24–33, Nos. 1–4, 6, 7, 10–14.

18 See Fig. 18.24, Nos. 3b–7b.

19 Cholidis 1992, Tf. 23–34, Nos. 52, 91, 93, 118, 121, 122; Wrede 2003, Abb. 107a.

20 In many texts these ša$_3$-tuku$_5$'s are produced or registered separately from bedframes: Sigrist 2000, 1582:1–2, 2156:7–9 (four of the ša$_3$-tuku$_5$'s are called 'old'); Steinkeller 1980, 81f. a-d, e (two old bedframes), f, m. In other cases it is indicated that a certain bedframe was equipped with a ša$_3$-tuku$_5$, see Steinkeller 1980, 81 g-I, or without it, see Lafont & Yıldız 1989, 694 rev. 1 'the inside (of the bedframe) is empty'. The ša$_3$-tuku$_5$ could be repaired, see Nikolsky 1915, 389 rev. 3: 168.3 g of wool ša$_3$-tuku$_5$ kal-ge-de$_3$ and Owen forthcoming, NES 49–15–021:1f.: 100.9 g of wool ša$_3$-tuku$_5$ kal-kala-ge$_2$-de$_3$.

21 Cholidis 1992, Tf. 23–41. Nos. 36, 43, 45, 47, 50, 90, 106 (stool!?), 129, 145–148, 152–155; Wrede 2003, Abb. 31b.

22 Killen 1980, Pls. 24–25, 31, 38; Fig. 13.

23 Cholidis 1992, Tf. 30: 95; cf. Tf. 41:155; Wrede 2003, Abb. 34e; Killen 1980, Pl. 24–25.

24 Cholidis 1992, Tf. 21–33.

25 Baker 1966, Figs. 1–4, 9, 18–20; Killen 1980, Figs. 5, 6, 10, 12, 14, 19, 27, 28; pl. 26, 30, 34, 35, 37; Mesopotamia: Baker 1966, Fig. 256 (Early Dynastic III), Fig. 271 (Urnammu); Steinkeller 1980,

81 g, i.

26 Killen 1980, Fig. 6 and compare Fig. 14f.; pl. 27–31, 33–35; stools and chairs: Pl. 47, 50.

27 Cholidis 1992, Tf. 23–37, Nos. 28, 38, 51, 60, 115, 118–121, 136; Wrede 2003, Abb. 107b, c.

28 Bed models: Cholidis 1992, Tf. 30–41, Nos. 94, 112, 124–126, 152, 154, 155. Perhaps this crossbeam is called ^{GIŠ}ZA.AN.KA in the texts: Grégoire 1996, 1932–274:6–10 (bed for a priestess); Crawford 1954, 348:1 + 7, 351:1–4, 417:4–6; Foster & van de Mieroop 1983, 57, 8:4–6.

29 Cholidis 1992, Tf. 13:27, Tf. 20:57, Tf. 30:106 (stool, not a bed). For stools, see Wrede 2003, 71ff. Compare the square stool with plaited seat from Kissonerga-Mosphilia, Cyprus (Theodossiadou 1996, 73f. + Fig. 1a).

30 Reiner 1992, 267 *še'ītu* b.

31 Baker 1966, Figs. 175, 176, 182, 184, 187–189, 194, 201, 203, 214–216; Killen 1980, Pls. 50, 54, 65–67, 72, 76, 86, 88.

32 Steinkeller 1980, 87 b; Owen forthcoming NES 48–06–003:1–4.

33 Steinkeller 1980, 88f. e; Owen forthcoming NES 48–04–003:1, NES 49–15–007:4, NES 49–15–015:1, NES 49–15–349:2 made out of white or multi-colored wool.

34 Oppenheim 1971, p. 408 *kirītu* C; von Soden 1965, S. 484 '*ein Seil?*'.

35 See note iii in Fig. 18.24.

36 Egypt: Landström 1970, Figs. 97–99, 104, 108–110, 117, 120, 122–123, 129, 131–133, 138, 143, 146, 165, 182, 201 and see the discussion on pp. 36, 42f., 46, 49. Mediterranean (large sailing vessels): de Graeve 1981, pp. 180–184 and Figs. 82, 83, 87, 106, 107. Mesopotamia (clay models of small sailing boats): de Graeve, pp. 176–180 and Figs. 17, 103, 104, cf. Figs. 20–21; three Neo-babylonian boat models from Uruk show a hole for a mast, see

Wrede 2003, 78f. Abb. 39 a–c and her reconstruction on p. 80 Abb. 40 (see here Fig. 18.23).

37 See Fig. 18.24, Nos. 8–9, 11–12 last column.

19 Under Canvas

by Susan Möller-Wiering

This paper gives a short survey about the different sources that information about ancient sails may be drawn from, such as pictures, documents, ethnographic parallels, archaeological material and experiments. The comparison and combination of these sources shed light on the question of how pre-Viking and Viking-Age sails in the North seem to have been constructed: i.e., not made up of differently colored panels but of solid-colored wool with colored reinforcements. Based upon this result, depictions of sails in the Aegean, from the Bronze Age onwards, are also interpreted as a reflection of the sail-makers' work. Furthermore, the above-mentioned sources lead to a catalogue or checklist which is supposed to help archaeologists distinguish fragments of sailcloth amongst archaeological textiles.

Introduction

During the last decades, the number of shipwrecks brought to light and excavated has increased rapidly. Based on this archaeological work, many ships of medieval[1] and other periods have been reconstructed on various scales, some of them very carefully, resembling the originals in every wooden detail.[2] However, when it comes to sailing, many of them are equipped with sails made of cotton or even synthetic fibers. Certainly, this anachronism is not only a question of costs but also the result of our limited knowledge of authentic sails.

Medieval and Younger Sources

In general, medieval sources are not rare, but they are not easy to

interpret, either. There are pictorial sources like the pre-Viking Gotlandic carved stone steles,[3] the famous Bayeux tapestry from the late 11th century,[4] and many other depictions from the late Middle Ages, some of them being very detailed. Besides iconographic evidence, there are written sources such as the saga literature in which one can read for example about woolen cloth used for sails or the stripes on the sails.[5] Another most interesting text is the 15th-century Italian essay *Fabrica di Galere* with a description of how to make a sail.[6]

Still very rare, though, are archaeological finds of medieval sails. Among the few remnants to be mentioned here are fragments from the Norwegian Oseberg ship from about 820/834 AD,[7] woolen cloth with ropes and a cringle,[8] as well as a similar cloth found in the Norwegian Gokstad ship,[9] dating to 895/900–905 AD.[10] Pieces of what are probably two sails from around 1400 have recently been identified among the woolen textile fragments found beneath the roof of Trondenes church in northern Norway (Fig. 19.1).[11] A most important find, though relatively young, are the sails of the *Wasa* which sank on her maiden voyage in 1628.[12] Many details may be studied there. Subsequently, ethnographic parallels, such as woolen sails from Norway from the 19th century and beyond offer a glimpse of traditional sail-making.[13] This information may be combined with historic sources such as the instructions on sail-making from Thomas Rajalin's 1730 book. And finally, experimental archaeology should be mentioned, though this is, of course, not an independent source for the reconstruction of sails as it is based upon the evidence mentioned above. However, one can learn from these experiments, for example, that wool is a suitable material for sails, and that differently shaped and constructed sails perform differently.[14]

The most detailed and obviously most reliable information refers to more modern periods: thus, one can question how far back any of the features may go. Furthermore, the sources are restricted by space and time–a problem that must be kept in mind regarding older sources as well. The content of these older sources is much more limited, and their reliability is, in each case, a matter of question. Therefore, in order to find any patterns and bits of information that may support or exclude each other, it seemed promising to examine and compare as many sources as possible:

written as well as iconographic, including some older evidence. This has been done and published before by the present author.[15] The comparison has shown that beyond the restrictions of the medium in question–paintings, coins, etc. –and beyond artists' traditions and common artistic means like the exaggeration of one or more elements, depictions of sails do show elements which are conspicuous for the sails of their time and area. Realistic elements may be found even when it is obvious that the artist was not familiar with sails or did not intend to be at all realistic.

Criss-cross Patterned Sails on Picture Stones and Coins

One old question concerning sails is how to interpret the oblique lines on the sails represented on some Gotlandic carved stones as well as on some so-called Hedeby coins. The Hedeby coins were found in different places in Scandinavia but are said to be coined in southern Denmark during the early 9th century.[16] Some of the ships are equipped with a sail showing a criss-cross pattern, while vertical lines divide the majority. Vertical lines are a feature not known in the usually older Gotlandic stones. Based on the comparison mentioned before, evidence and arguments have been collected which might give an explanation for these features. Since they have also been discussed already in German[17] as well as in English[18] works, it may be sufficient to present them here as a table (Fig. 19.2).

The sources indicate that a given raw material was combined with a particular way of sail-making, thereby causing the sails to look different and even be depicted differently. Thus, it is reasonable to interpret the vertical lines as seams on sails made of linen or perhaps another plant material. However, the early criss-cross patterned sails in the North may be regarded as being made of wool, with reinforcement strips which were often colored and sewn onto the sheet either parallel or obliquely to the edges. These narrow, colored strips characterized the sails visually. And it was these sails that were typical for pre-Viking and Viking ships. Thus, our common idea of Viking sails with broad panels in red and white or blue and yellow might not be correct.

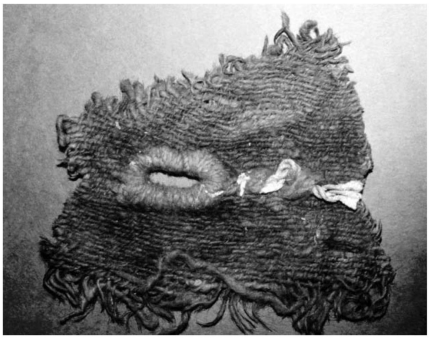


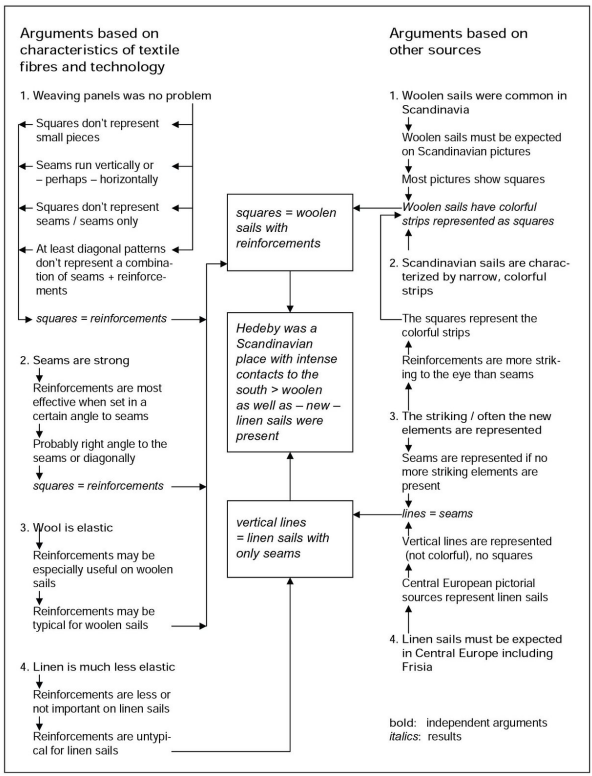
Fig. 19.1: Woolen sail fragment from Trondenes Church, Norway, dating to c. 1400 AD.

This explanation also refers to those few carved steles in which the sails' patterns resemble a chess board: e.g., the stone from Gullarve, dating to the first half of the 8th century.[19] The contrast between dark and light squares simply exaggerates and thus emphasizes the impression of a criss-cross pattern. Since exaggeration has been a common means of accentuation, in oral as well as written and pictorial description, there seems to be no need to interpret these sails differently.

Criss-cross Patterned Sails in the Mediterranean

Criss-cross and chess-board patterns are not restricted to the woolen sails of the North. One of the arguments that led to the interpretation presented above was the previously mentioned *Fabrica di Galere.*[20] There, one can learn that in Northern Italy in the 14th century, sails should be made mainly of fustian, a mixture of linen and cotton and a new material in the late medieval period. Only the most stressed parts were made of hemp. Vertical and horizontal reinforcements made up a grid covering the whole sail. Following the description, there is a sketch showing a ship with a criss-cross patterned sail, so one can be quite sure that the squares represent the reinforcements on a fustian sail. Other ships of the same time and area[21] exhibit the same pattern, which leads to the assumption that they were also equipped with fustian sails with reinforcement strips.

Fig. 19.2: Evidence and arguments used for the interpretation of the sails on the Hedeby coins.



There is also much older evidence of sails with criss-cross or chess-board patterns from the Aegean. The latter are known from Greek vases, two of which–dating to c. 700 BC and c. 580 BC, respectively–are published by DeVries.[22] In both cases the squares are placed vertically and horizontally. A look further back to the Bronze Age on Crete leads to a graffito from Malia[23] and to seals depicting ships with square sails.[24] These are criss-cross patterned, the lines running either parallel or obliquely to the edges. Thus, there are strong similarities between these old depictions and those of Viking and medieval times and it seems worth projecting the results found there onto this material. As a first step then, the oblique lines on the seals may be viewed as reinforcements, rather than ropes or a combination of both. Secondly, there is no reason to

interpret the grids parallel to the edges in any other way. Thirdly, the same may apply to the much younger sails represented on the vases, though in these cases, a net of ropes like those during Roman times must be taken into account. Since contemporary supporting sources are missing, the manner in which the sails are depicted does not give a hint as to their material. Presumably, plant fibers were used–Black and Samuel[25] collected some quotations covering the period from the 4th century BC onwards. And in the Bible, Egyptian sail cloth made of embroidered linen is mentioned in Ezekia's 700 BC description of the city of Tyre.[26] On the other hand, in Mesopotamia around 2000 BC, sails were woven possibly from goat hair.[27] However, no matter which material was actually used for the Aegean sails, the evidence from northern Europe and medieval Italy shows that reinforcements may be useful on sails made of animal as well as of plant fiber, depending on the quality and characteristics of the fabric. The depicted lines may well reflect the sail-makers' work.

Identification of Sail Remnants

Documentary as well as iconographic evidence, ethnographic parallels and experiments with replicas will help the archaeologists place their finds in their historical context. However, our main sources are always the finds themselves –though in the case of sails, they are very few as of yet.

Based on the comparison of different sources, a list of features characteristic for sails has been established.[28] It contains indispensable features like suitable seams; others that are typical for certain types of sails like reinforcements; plus some which are just optional and may apply to textiles having other functions, e.g., changing colors along a seam. Most of the features are present in more than one period of time and in more than one category of evidence, e.g., the combination of cloth and ropes.[29] This means that–in spite of their diversity–the sources support each other very well. Using this list, the identification of the sail fragments from Trondenes church became possible. And it may help us to find more remnants and information about sails, sail production and their use in former times.

Notes

1 In this paper the term ‘medieval’ refers to the definition of continental scholars which covers the period from about 500 AD to about 1500 AD.

2 See Möller-Wiering 2002, 20ff.

3 Lindqvist 1941–1942.

4 E.g., Grape 1994.

5 Falk 1912, 62–63.

6 Bellabarba 1988, 122–123.

7 Crumlin-Pedersen 1997, 19.

8 Ingstad 1982, 87–88.

9 Ingstad 1988, 135–136.

10 Crumlin-Pedersen 1997, 19.

11 Möller-Wiering 2002, 146.

12 Westheden Olausson 1998.

13 Andersen et al. 1989; Möller-Wiering 2002, 89ff.

14 Andersen 1997; Vinner 1997.

15 Möller-Wiering 2002.

16 Crumlin-Pedersen 1997, 172ff; Steen Jensen & Jørgensen 2000.

17 Möller-Wiering 2002.

18 Möller-Wiering 2003.

19 Lindqvist 1941–1942, 71; Möller-Wiering 2002, 34.

20 Bellabarba 1988.

21 E.g., Hutchinson 1997, 41, Fig. 2.10.

22 DeVries 1972, 42, Fig. 3; 43, Fig. 8.

23 van de Moortel 1994, 300–301, Figs. 1 and 2.

24 E.g., Gifford & Gifford 1997, 203, Fig. 6

25 Black & Samuel 1991, 220.

26 Ezekiel, 27.

27 Waetzoldt, this volume.

28 Möller-Wiering 2002, 111, Table 1.

29 Möller-Wiering 2002, 112f, Tables 2 and 3.

20 Similarities and Distinctions of Minoan and Mycenaean Textiles

by Edith Trnka

Indications from the Aegean iconography show a complex richness in the shapes of garment types. Typical for the male Aegean costume are loin-clothes, kilts and robes of different lengths, while it is rare to see representations of cloaks, loose robes and hides. The Aegean female costume is formed by bodices, skirts and long robes. Cloaks, loose robes and 'hide skirts' are unusual. In Mycenaean and Minoan garments, there is little difference in the combination and use of different weaving techniques, textile patterns of geometric or naturalistic nature, plain or patterned border bands and contrasting colors. The typology of the Aegean costume types covers a wide chronological span, so that in general, Aegean garment types are not a significant chronological indicator. Differences in design may refer more to age, social rank and activity of the wearer.

Textiles are an expression of the way of living and thinking of a group of individuals.[1] Clothes are an extension of the body, whereby the nature of a culture creates its own language of design.[2] They fulfill different functions, besides protecting the body–they have an aesthetic and a symbolic meaning, so those clothes are continuously interrelated to sex, social rank, and behavior of the wearer.[3] The shapes of clothing mostly depend on their function, aesthetic demands, and of course, on the technical level of the textile production.

Concerning the Aegean Bronze Age no textiles survived, except a few scraps of cloth and some textile impressions on metals and pottery.[4] Evidence from the Aegean iconography shows a complex richness in the shapes of garment types. Sources are wall paintings, stone, metal, ivory and ceramic objects, pottery and seals.

Typical for the Aegean male costume are belts, loin-clothes, kilts and robes in different lengths, with only rare representations of jackets,[5] cloaks, robes with flounces, loose robes[6] and 'hide' types. Belts[7] normally occur as band- or bulge-shaped, but seldom rope-shaped alone or in combination with a codpiece, [8] or different costume types.

The Minoan male costume is dominated by a wide variety of loin-cloth types and kilts.[9] Of the thirteen different loin-cloth types found from Middle Minoan (MM) I onward, the type with a codpiece and backflap characterizes the typical Minoan loin-cloth from MM III to Late Minoan (LM) II. The kilt–often interpreted as the standard, male Mycenaean costume –already appears on Crete from MM II and later on the Cycladic islands of Thera in LM IA and Kea in LM IB.[10]

Short and long robes dominate the Mycenaean male costume[11] from Late Helladic (LH) I in contrast to Crete, where they are prevalent in LM II/IIIA. Exceptional is the type of long robe with flounces[12] seen on Crete in LM II/ IIIA and on the Greek mainland during LH IIIB2.

Rare information comes from cloaks,[13] rectangular or semi-circular in shape, and in existence since MM I on Crete and from LH I onward on the mainland, versus that of Thera[14] with different types consisting of different lengths, plain or single- or double-bordered and tied by strings.

Exceptional are representations of hides, which appear on Crete[15] from MM IIIB onward, in comparison to the late existence on the Greek mainland in LH IIIB. Imitation 'hides' created by special weaving techniques are represented quite early on Thera in LM IA and Kea in LM IB, but quite late on Crete in LM IIIA.

The Aegean female costume[16] is formed by short-sleeved, open-fronted bodices, skirts and long robes. Cloaks, loose robes[17] and 'hide skirts' are extremely rare. Exceptional is the representation of

a rope-shaped belt, a transparent, veil-like cloak and a loose robe on Thera.

From MM I till LM I, bodices are represented with a high, standing collar, but from MM II onward, the typical female costume consists of a short-sleeved, open-fronted bodice with border bands, plain or patterned, skirt, and band- or bulge-shaped belt. Skirts appear in two types: bell-shaped or flounced (from MM IIIB onward)–both plain or elaborately patterned. Additionally an underblouse and an apron can be worn as a closed bodice occurs during LM IIIB-C on Crete.

The Theran female costume[18] appears at first glance similar to the Minoan one, but it has a different combination of a long robe, partly transparent, with a flounced skirt. Extremely rare is a band skirt and/or the combination of a band- and rope-shaped belt.

From LH II onward, the Mycenaean female costume,[19] also consisting of a bodice in an opened or closed version, skirt and belt, shows regional distinctions with regards to bodices –with openings and types of flounced skirts created by different color and textile pattern combinations.

Long robes[20] appear on Crete quite late in LM II/IIIA, and also on the Greek mainland, from LH IIIA onward, with textile patterns. Worth mentioning as a 'female' costume type is the loin-cloth with backflap and the problematic representation of a codpiece in the Minoan and Mycenaean iconography (LM IA–LM II/IIIA and LH IIIB).[21] Another female costume type, the so-called 'hide skirt', appears quite early on Crete,[22] from MM II onward, but a little bit later in the Theran wall paintings in LM IA.

A lot of costume types are composed only of simple rectangular lengths of cloth, although indications of well designed loin-cloth types, bodices and skirts refer to the fact that elaborate cutting, fitting and stitching were carried out–otherwise known as tailoring.

The Minoan and Mycenaean costumes differ not so much in typology as in the combination and use of different weaving techniques, textile patterns[23] with geometric or naturalistic motifs: plain or patterned border bands and contrasting colors.

The Minoan textile patterns, especially from the end of the Old Palace Period onward, are marked by the greatest complexity and

variety, but also by a kind of refinement concerning color combinations–in contrast to the simplicity of a restricted two-color system of the Mycenaean ones.[24] Theran textiles show more simple patterns, either of geometric or floral style, but they are accentuated by a strong light/dark contrast created by different colored border-band combinations.

Because of a lack of Aegean Bronze Age preserved textiles, no exact chronological and geographic distribution of textile techniques can be worked out. Beyond different weaving techniques,[25] some other decorative techniques might have been used for the production of decorative elements for costumes: embroidery, [26] tablet weaving,[27] sprang techniques,[28] bead work,[29] appliqué of cloth, leather or metal[30] in geometric or naturalistic designs, and possibly painting.

The typology of Aegean costume types shows a wide chronological span, so that in general, Aegean garment types are not a significant chronological indicator, with the exception of textile patterns. Rather than an indication of ethnicity, differences in design may refer more to the age, status and activity of the wearer.[31] Distinctions like textile patterns, colors and band decorations within the fabrics might indicate the social rank of the wearer.[32]

Aegean Bronze Age textiles have their own aesthetics and are an expression of a highly creative culture, especially regarding tailoring and the use of textile patterns and color combinations.

Notes

1 This article is based on an unpublished dissertation by the author, Trnka 1998.

2 Petraschek-Heim 1966, 9; Wilson 1989, 12; Kiener 1956, 21.

3 Mills 1984, 255.

4 Barber 1991, 174, 312; Carington-Smith 1975, 141–142, 160–163, 174–175, 411–412, 458–463; Trnka 1998, 220–223. See also Unruh, this volume.

5 Trnka 1998, 37–38. Jackets are represented in the Minoan

iconography from MM I till MM III only.

6 A loose robe consists of a piece of cloth diagonally wrapped around the body: Trnka 1998, 48–50 (Crete), 63 (Thera), 66A (Kea), 89 (Greek mainland); Verlinden 1984, 99; Marinatos 1967, A25.

7 Sapouna-Sakellarakis 1971, 130–139; Stupka 1972, 8–56; Trnka 1998, 5–7 (Crete), 58 (Thera), 68–69 (Greek mainland).

8 With full discussion, Trnka 1998, 8–12; Sapouna-Sakellarakis 1971, 123; Verlinden 1984, 98; Marinatos 1967, A21.

9 Sapouna-Sakellarakis 1971; Trnka 1998, 13–35; Bieber 1967, 21; Giesecke 1988, 91–98; Mariantos 1967, A21–24; Pekridou-Gorecki 1989, 60–63; Rutkowski 1991, 37–38; Rehak 1996, 98–99. See, as a contrast, the eight Mycenaean loin-cloth types: Trnka 1998, 70–77.

10 Trnka 1998, 58–61 (Thera), 65–66 (Kea).

11 Trnka 1998, 39–41 (Crete), 78–85 (Greek mainland); Bieber 1967, 21; Verlinden 1984, 99; Marinatos 1967, A24–25.

12 Trnka 1998, 41–42 (Crete), 85–86 (Greek mainland).

13 Trnka 1998, 43–47; Sapouna-Sakellarakis 1971, 104–110; Rutkowski 1991, 40.

14 Trnka 1998, 61–63 (Thera), 66 (Kea), 87–88 (Greek mainland).

15 Trnka 1998, 51–54 (Crete), 63–64 (Thera), 90–91 (Greek mainland); Bieber 1967, 21; Nilsson 1950, 155–156; Sapouna-Sakellarakis 1971, 122–123.

16 During EM I–III, only a simple dress is represented, Trnka 1998, 101–129; Bieber 1967, 21–22; Marinatos 1967, A25–30; Pekridou-Gorecki 1989, 56–57.

17 Represented only in Thera, in combination with a long robe or blouse: Trnka 1998, 151–152 (Thera), 134 (Crete).

18 Trnka 1998, 143–151; Immerwahr 1990, 54–58; Televantou

1982, 113–135.

19 Trnka 1998, 161–188.

20 Trnka 1998, 151 (Thera), 194–195 (Greek mainland).

21 Trnka 1998, 135–137 (Crete), 197 (Greek mainland).

22 Trnka 1998, 138–139 (Crete), 198 (Greek mainland) a shaggy version, 153 (Thera), 157 (Kea).

23 For discussion of Minoan and Mycenaean textile patterns: Trnka 1998, 234–247; Barber 1991, 370–371.

24 With the exception of border-bands; Trnka 1998, 34; Carington-Smith 1975, 469–470.

25 Trnka 1998, 248–253.

26 Trnka 1998, 250; Barber 1991, 312.

27 Trnka 1998, 249–250; Barber 1991, 118–12; Carington-Smith 1975, 486, 481–485; Geijer 1979, 38–39, 219–221.

28 Trnka 1998, 249–250, 252; Ioannou-Giannara 1990, 30; Barber 1991, 122–124; Geijer 1979, 221–224.

29 Trnka 1998, 250–251; Younger 1992, 273–274; Iakovidis 1977, 113–119.

30 Trnka 1998, 251; Konstantinidi 1995, 25–28.

31 Rehak 1996, 50.

32 Trnka 2000.

21 Re-considering Alum on the Linear B Tablets

by Richard Firth

The paper begins by describing what is meant by the modern term alum and the purposes for which it can be used, and then steps back to what was meant by the term in ancient times and the purposes for which it might have been used in the Bronze Age. There is a discussion of the appearance of 'alum', tu-ru-pte-ri-ja*, on the Linear B tablets and in particular on the Pylos tablets, An 35 and Un 443. After an investigation into the possible interpretations, it is suggested that* tu-ru-pte-ri-ja *was probably alum-stone (rather than alum). This would have been acquired by the two men named on the Pylos tablets,* ku-pi-ri-jo *and* a-ta-ro *(*a$_3$-ta-ro*). They would have roasted the alum-stone on fires to convert the alum-stone into alum. The resulting roasted stone would have been broken into fragments and probably used as a mordant in dyeing.*

Introduction

The aim of this paper is to re-consider the alum which is recorded on the Linear B tablets (i.e., as *tu-ru-pte-ri-ja*, on PY An 35, Un 443, TI X 6 and, as *tu-ru-pe-te[*, on KN X 986).[1] However, rather than progressing straight to a discussion of the Linear B tablets, it is worthwhile considering the nature of alum and its uses in the ancient world.

What is Alum?

In modern terminology, the word alum can be used to represent a whole series of chemicals which are crystallised double sulphates of

the form, $M(I)M(III)(SO_4)_2.12H_20$, (where M(I) and M(III) represent metals with valencies of one and three, respectively). However, the terms common alum, potash alum or potassium alum refer specifically to potassium aluminium sulphate, $KAl(SO_4)_2.12H_20$ (which is also written in the form $K_2SO_4.Al_2(SO_4)_3.24H_20$). Ammonia alum is ammonium aluminium sulphate ($NH_4Al(SO_4)_2.12H_20$). Soda alum or sodium alum is sodium aluminium sulphate, $NaAl(SO_4)_2.12H_20$. Alum, paper-makers' alum, pearl alum, pickle alum, cake alum, filter alum or patent alum is aluminium sulphate ($Al_2(SO_4)_3$, with various hydrated forms). There are numerous other chemicals which can be categorised as alums in modern terminology: however, the above list of specific chemicals is sufficient for present purposes.[2]

The basic properties of these alums include the following:[3]

–**Potassium alum.** White, odourless crystals having an astringent taste. Soluble in water; insoluble in alcohol. Solutions in water are acid. Non-combustible.

–**Ammonia alum.** Colourless crystals, odourless, strong astringent taste. Soluble in water, glycerol; insoluble in alcohol.

–**Sodium alum.** Colourless crystals, saline, astringent taste, effloresces in air. Soluble in water, insoluble in alcohol. Non-combustible.

–**Aluminium sulphate.** White crystals, soluble in water, insoluble in alcohol.[4]

In modern times, each of these alums can be manufactured by chemical processes. However, potassium alum is readily obtainable in significant quantities from naturally occurring minerals such as alunite (or alum-stone, $K_2Al_6(SO_4)_4(OH)_{12}$) and kalinite, $KAl(SO_4)_2.12H_20$, which are found in regions where there has been volcanic activity. Alum-stone can be converted into potassium alum by roasting it in air and then separating out the soluble potassium alum from the remainder by dissolving it in water and then, if required, crystallising the alum. Alunogen (aluminium sulphate) also occurs naturally in a crystalline form, again in volcanic regions.

If we now consider the ancient usage of the word alum, *alumen*, Singer[5] informs us that in Roman times it 'stood for a considerable and ill-defined group of astringent substances' and among them

were:[6]

- –potassium alum, which, as we have noted, was found as kalinite in volcanic regions.
- –hydrated double sulphate of iron and aluminium, $FeSO_4.Al_2(SO_4)_3.24H_20$, also known as halotrichite, which is found around fumaroli in volcanic regions.
- –other comparable minerals with bivalent elements other than iron, such as magnesium (pickeringite formed by the weathering of pyritic schists) and manganese (apjohnite).
- –alunogen, aluminium sulphate, which forms as a white encrustation either under volcanic conditions or by the decomposition of the pyrites in carbonaceous shales.
- –a variety of minerals containing iron sulphate
- –a range of other substances which are unrelated except for having styptic properties or an astringent taste.

Levey[7] informs us that 'alum occupies a unique position in the history of chemistry … [because] … it was one of the few known compounds naturally obtainable in a more or less pure state.' Alum readily dissolves in hot water and crystallises out as the water cools and, by repeated re-crystallisation, impurities can be removed.[8] This process occurs naturally and is described by Pliny,[9] 'All alum is produced from water and slime, that is, a substance exuded by the earth; this collects naturally in a hollow in winter and its maturity by crystallisation is completed by the sunshine of summer; the part of it that separates earliest is the whiter in colour'. The crystals which form first are purer: thus, when Pliny refers to 'white alum', he usually meant fairly pure potassium alum or aluminium sulphate. Pliny's 'coloured alum' is either iron alum or an alum containing iron or manganese[10].

What is Alum Used For?

The modern uses of alums include the following:[11]

- –**Potassium alum.** Dyeing (mordant), paper, matches, paints, tanning agents, water-proofing agents, purification of water, aluminium salts, food additive (E 522), baking powder, astringent, cement hardener.
- –**Aluminium sulphate.** Sizing paper, lakes, alums, dyeing mordant, foaming agent in fire foams, cloth fireproofing,

white leather tannage, catalyst in manufacturing ethane, pH control in paper industry, waterproofing agent for concrete, clarifier for fats and oils, lubricating compositions, deodoriser and decolorizer in petroleum refining, sewage precipitating agent, water purification, food additive (E 520).[12]

It is worth noting that there is a reasonably high level of commonality between both the properties and the uses of these chemicals. In particular, we should note amongst these lists the astringent taste of these chemicals and their use for tanning, as a mordant for dyeing, for water-proofing, fire-proofing and in medicines.[13]

Pliny[14] tells us that 'in Cyprus there is a white alum and another sort of a darker colour' and that these can be used as a mordant in dyeing. The white alum is most useful for dyeing woollens bright colours and the darker alums (containing the salts of iron and other heavy metals) would produce darker colours.[15] The following sections in Pliny[16] continue to discuss alum, but form a separate strand of discussion, specifically considering crystalline alum and its medical uses. These uses include ingestion of the alum. This crystalline alum is recorded as being found in Spain, Egypt, Armenia, Macedonia, Pontus, Africa and the islands Sardinia, Melos, Lipari and Stromboli.[17] Pliny includes a lengthy passage on the alum of Melos. He also notes that alum was used for the treatment of hides.

Dioscorides[18] discusses specifically the medical uses of alum, and he notes that this type of alum was found in Egypt, Melos, Macedonia, Sardinia, Liparis, Hierapolis in Phrygia, Africa, Armenia Rubrica and many other places.[19]

Pliny[20] also describes Phrygian stone, 'which occurs in porous lumps. After being soaked in wine it is roasted, and bellows are used to fan it until it turns red, whereupon it is quenched with sweet wine, and the process is repeated three times on each occasion. It is of use only in dyeing garments.' This is evidently a description of the production of potassium alum from alum-stone. In addition, the Leyden and Stockholm papyri from Egypt describe the use of Phrygian stone as a mordant in the process of dyeing wool purple: 'Preparation of purple: Break in small pieces Phrygian Stone; bring to a boil and having immersed the wool, leave it till it

becomes cool, then throwing into the vessel one mina of algae, boil and throw in the wool and letting cool, wash it in sea-water to purple coloration. The Phrygian stone is roasted before breaking.'[21]

The Leyden and Stockholm papyri (c. 300 AD) contain numerous examples of the uses of alum. These are mostly associated with working with gold and silver.

Aulus Gellius (2nd century AD) quotes a passage by Quintus Claudius Quadrigarius on the use of alum to cover wood in order to prevent it from being combustible, 'they were never able to set it on fire, so thoroughly had Archelaus covered all the wood with alum.'[22]

The above texts all date from Roman times. If we move towards earlier texts, then, for example, based on ancient Mesopotamian writings, Levey[23] states that alum was used for tanning, dyeing, glass-making, washing and in medicine. He specifically notes that there was no evidence in those texts for the use of alum for making wood fireproof. The medical uses given here are more limited. They include the following: blowing crushed alum into the ear through a reed; as a component in a salve; use in medicines as a cure for infections; as an ingredient in a prescription for bathing the eyes; as a mouth wash. Egyptian texts describe the use of alum in medicine–as a component in an inhalant[24] and in a poultice or salve.[25] Specifically, these imply that in earlier times, although alum was used to treat ears, eyes and to cleanse the mouth, the medical uses requiring ingestion of alum seem to have been more limited.[26]

ALUM, στρυπτηρία, στυπτηρία and tu-ru-pte-ri-ja

Following Chadwick,[27] it has become accepted that *tu-ru-pte-ri-ja* should be translated as στρυπτηρία 'of alum'.[28] The word στρυπτηρία was used in an inscription found at Priene in Asia Minor. However, the Greek word more generally used for alum is στυπτηρία. The suggestion is that στρυπτηρία became στυπτηρία by dissimilation.[29]

Before going further, let us consider the technical definitions represented by the two English words astringent and mordant as they might apply to alum. According to the New Shorter Oxford

Dictionary,

astringent	A. causing contraction of the body tissues, styptic [i.e., 1. causing contraction of organs or tissues, harsh acid or raw to the palate. 2. of a medicine, checks bleeding.]
B. an astringent medicine or substance.	
mordant	A. a substance enabling a dye or stain to become fixed in the fabric, tissue, etc., on which it is used.
B. corrosive; pungent, biting.	

Thus, according to these definitions, alum is an astringent because it is acidic and it can be used as a styptic to check bleeding (in more recent times, as an alum stick, which is used on cuts after shaving). Alum is a mordant because it can be used to enable a dye to become fixed onto fabric and, as a weak acid, it is mildly corrosive.

Now let us consider the technical senses contained within the two groups of words relating to στρυπτηρία and στυπτηρία

στρυφνόω	act as an astringent
στρυφνότης	rough, harsh taste, sourness
στυπτηρία	name of any of group of astringent substances containing alum or ferrous sulphate
στύφω	to contract, draw together, to treat fabrics with a mordant; to be an astringent

Thus, it would appear that initially there was one word, *tu-ru-pte-ri-ja*, that represented alum and was defined by the properties of alum as being both an astringent and a mordant.[30] This then seems to have become divided into two groups of words: those such as

στρυφνόω, which have the sense of an astringent; and those such as στύφω, which retained the sense of serving as both an astringent and a mordant.

tu-ru-pte-ri-ja *on the Pylos Tablets*

Alum, *tu-ru-pte-ri-ja*, appears on two separate Pylos tablets, An 35 and Un 443. It is worthwhile beginning by considering the features of these two tablets separately.

The first three lines of text in Fig. 21.1 describe builders being sent to work in various places within the area controlled by Pylos. The latter two lines of text on An 35 are separated from the first three by a blank line and the two pieces of text may not be connected. These describe an exchange where the palace receives an unspecified quantity of alum, and *a-ta-ro* receives six kg of wool, four she-goats, three garments (**146*), 288 litres of wine and 384 litres of figs.

This is a rectangular page-shaped tablet, written, at least in part, by Hand 3 and found on the bench in the south corner of Room 8.[31] Palaima[32] lists An 35 together with Fn 7 (previously An 7), because the two tablets have similar dimensions, are written by the same scribe and found in the same location.[33] We could also include Vn 10 which was also written by Hand 3 and found nearby, although it is a smaller rectangular-shaped tablet.

Fn 7 and An 35 are both concerned with builders, *to-ko-do-mo*. In the case of Fn 7, the tablet describes monthly rations which are to be issued to builders, cutlers (sword makers), *pi-ri-e-te-si*, and three named individuals. Vn 10 lists materials supplied by the woodcutters, *du-ru-to-mo* , to the workshops of the wheelwrights, *a-mo-te-jo-na-de*.

It is perhaps worthwhile drawing attention to some of the other tablets found in the same location but written by different scribes. An 18 lists men who are absent, including builders, carpenters, *te-ko-to-na-pe*[34] and cowherds, *qo-u-ko-ro* . We can identify other names on the list as shepherds, who also appear on Cn 4. Tablet An 5 is also concerned with carpenters.

Thus, we have a group of tablets which are dealing with builders, carpenters, sword makers, wheelwrights, woodcutters, cowherds

and shepherds. Specifically, the tablets are concerned with allocating work to them, noting when they are absent, providing them with materials for their work and also with rations. Amongst these, we have the allocation of goods to *a-ta-ro* in exchange for an unspecified amount of alum.

One possible implication would be that the alum is to be used by one or more of the group of workers already noted. Since we cannot name a use of alum for woodcutters, carpenters, wheelwrights and herders of livestock, it would seem to follow that the alum is for the builders or sword makers. Specifically, builders could have used alum to make wooden beams less combustible[35] and sword makers could have used the solution of alum in water as an weak acid for cleaning the surfaces of metals.[36]

An 35

.1 to-ko-do-mo , de-me-o-te
.2 pu-ro VIR 2 me-te-to-de VIR 3
.3 sa-ma-ra-de VIR 3 re-u-ko-to-ro VIR 4
.4 *vacat*
.5 a-ta-ro , tu-ru-pte-ri-ja , o-no
.6 LANA 2 CAP^{f} 4 **146* 3 VIN 10 *NI* 4

Fig. 21.1: Linear B tablet An 35 from Pylos.

However, an alternative line of reasoning is suggested below in Fig. 21.2 based on the premise that *a-ta-ro* was a man who roasted alum-stone to produce alum. We know from Pliny's accounts that alum produced in this way was used as a mordant in the dyeing of textiles.

In this case, our interest is in the first line, describing an exchange where the palace receives an unspecified quantity of alum and *ku-pi-ri-jo* receives 30 kg of wool and ten garments (**146*). The latter two lines are problematic but they do not appear to be associated with the trade for alum.

This tablet is one of a group of tablets written by Hand 6 with Stylus S6. This group includes Un 6, 443 and 853. Palaima[37] records that Hand 6 deals with apparent offerings to religious figures. All of the fragments which were joined to make up this group of tablets were found in a position which was clearly displaced from its storage location within the archive. However, the

evidence available does support Palaima's suggestion that the tablets should be considered as coming from Room 8 and it is probable that Un 6 was originally in a position above the southwest bench, i.e., in the same area as An 35.[38]

Fig. 21.2: Linear B tablet Un 443 from Pylos.

Un 443

.1 ku-pi-ri-jo , tu-ru-pte-ri-ja , o-no LANA 10 *146 10
.2 po-re-no-zo-te-ri-ja LANA 3
.3]do-ke , ka-pa-ti-ja , HORD 2 te-ri-ja GRA 1 LANA 5

Un 6 and Un 853 are religious offerings of animals and, more interesting for present purposes, offerings of wool and textiles, *TELA + TE*, **146* and possibly **166 + WE*.[39] The first line of Un 443 describes the issuing of goods to *ku-pi-ri-jo* in exchange for alum, using a form of text which closely resembles that of An 35. It is evident that the exchange for alum is not via a religious person (or a divinity) but it may be for their subsequent benefit, as part of a religious offering. Thus, here, we may allow ourselves to be led towards suggesting that the alum may be associated with the textiles and, therefore, may be for use for cleansing or as a mordant in dyeing.

We could go further and note that Un 6 was probably originally stored in the same area as An 35 and also note that the form of An 35 is very close to that found on Un 443, and thus, suggest that An 35 and Un 443 could be exchanging alum for the same purpose. Regrettably our evidence is not sufficiently strong, and we are inevitably left wishing that there was more information available to us.

ku-pi-ri-jo *and* a-ta-ro

Let us consider the words *ku-pi-ri-jo* and *a-ta-ro*, which are included on these tablets in close association with the exchange for alum. It is convenient to write this section in the form of an investigation, considering a number of alternative suggestions before arriving at the preferred interpretation.

We will begin by noting the suggestion of Himmelhoch[40] who

notes that *ku-pi-ri-jo* on Un 443 could be (1) a personal name, i.e. 'to Kuprios, a load of alum'; or (2) an adjective modifying *o-no*, i.e. 'a Cypriote load of alum'. However, it is reasonable for us to expect a parallel interpretation for *a-ta-ro*, so that if *ku-pi-ri-jo* is a man's name on Un 443, then *a-ta-ro* should be a man's name on An 35. Similarly, if *ku-pi-ri-jo* is an adjective, then *a-ta-ro* should be an adjective.

Let us consider Himmelhoch's first suggestion, that *ku-pi-ri-jo* and *a-ta-ro* are men's names. We should remember that alum was imported to Messenia from overseas. Therefore, there would seem to be three possibilities, *ku-pi-ri-jo* and *a-ta-ro* are:

a) the persons responsible for taking the goods and exchanging them for alum.
b) the persons to whom goods are taken to exchange them for alum (i.e. resident traders).
c) the sea-farers who had arrived with alum for trading.

Option (c) seems intrinsically unlikely because it implies three things. Firstly, that the scribe at the palace at Pylos knows the names of the sea-farers. Secondly, that the palace wanted to trade directly for alum when the ship arrives. Thirdly, that the sea-farer would accept bulky items such as hundreds of litres of wine and figs as part of an exchange.

Let us consider option (b). Chadwick[41] notes that *ku-pi-ri-jo* appears a number of times together with the word *o-no*, implying a 'payment'. He suggests that *ku-pi-ri-jo* could have been a Cypriot trader. Palmer[42] objects strongly to this interpretation because he considered that it introduced an excessive number of hypotheses. In particular, it implies one meaning of *ku-pi-ri-jo* on KN Fh 347, 361, 372 etc. and another meaning of the same word when it appears on KN Ga 517, which was excavated from a nearby find-place, where he interprets it as '(seed) from Cyprus'. *Documents*[2] gives *ku-pi-ri-jo* as an unguent maker at Knossos[43] and a man's name at Pylos. Palaima[44] reviews the usage of *ku-pi-ri-jo* at Knossos and concludes that it could be interpreted as a designation of goods bound for Cypriote markets. However, such an interpretation would clearly be anomalous for PY Un 443 because the alum would have been imported into Messenia from volcanic locations such as Cyprus and Melos. Essentially, there is a recognition that the word *ku-pi-ri-jo*

might be used in a different sense on different tablets. Thus, after many years of reflection, Palmer's original objection is not sustained and we can return to Chadwick's suggestion that *ku-pi-ri-jo* was a Cypriot trader.[45]

Is it possible that we can extend this to *a-ta-ro*? *Documents*[2] links *a-ta-ro* with *a3-ta-ro* ,[46] Aithalos, and *a-ta-ro-we* with *a3-ta-ro-we*, *Aithalowens* cf. Αἰθαλόεις, a river in Mysia, Anatolia. We could argue that Mysia is adjacent to Phrygia (which, we have noted, is a source of alum-stone) and suggest that *a-ta-ro* is also someone who has arrived from overseas and settled in Messenia as a trader. However, this seems very contrived and open to the sort of objections that were raised by Palmer against Chadwick's original suggestion.

Another possibility is that *a-ta-ro* is a man's name which contains a descriptive element. Αἴθαλος has the sense of sooty, smoky; αἰθαλόεις translates as smoky, sooty, black ashes that are burnt out, burning blazing, burnt-coloured. Perhaps the rôle of *a-ta-ro* was to prepare alum by roasting alum-stone.

The word, *a-ta-ro*, appears only once in the Mycenaean texts. Similarly, the closely related word, *a3-ta-ro*, also appears only once and is as the name of a blacksmith on tablet PY Jn 415. It is quite possible that *a-ta-ro* is a variant spelling of *a3-ta-ro*, so that *a-ta-ro* on An 35 could be the same person as the blacksmith on Jn 415.[47] This would then give us a blacksmith, Αἴθαλος, who could have used his fire to roast alum-stone to produce alum for the palace. This interpretation would apply equally well to *ku-pi-ri-jo* since this is also the name of a blacksmith, listed on PY Jn 320.[48] Thus, we have demonstrated an interpretation which applies equally strongly to *ku-pi-ri-jo* and *a-ta-ro* (*a3-ta-ro*).

Therefore, the suggestion is that the blacksmiths, *a-ta-ro* (*a3-ta-ro*) and *ku-pi-ri-jo*, would have been provided with the commodities listed in An 35 and Un 443 in exchange for alum. They would have obtained alum-stone by trading and they would have roasted the alum-stone to produce alum.[49] It is worth emphasising that, if we accept this interpretation, then we are no longer bound to assume that the alum has come from Cyprus[50].

Alum in this form would be relatively impure[51] and we would return to Pliny's statement[52] that roast Phrygian stone was only of

use for dyeing. Thus, at the end of this long discussion we reach the conclusion that was most likely from the outset: that the alum at Pylos was most probably used as a mordant for dyeing.

Before concluding, we should, for completeness, consider Himmelhoch's second alternative, i.e., that *ku-pi-ri-jo* and *a-ta-ro* are adjectives. In this case, *ku-pi-ri-jo tu-ru-pte-ri-ja ono* would be 'a Cypriot load of alum' and *a-ta-ro* could possibly be interpreted as roasted 'alum-stone'. Whilst this suggestion is plausible, it is considered to be less sustainable than the option given above.

We should also briefly note the two other mentions of alum on the Linear B tablets. In practice, the Knossos tablet X 986 does not add anything to our discussion because of the sparseness of its contents. The Tiryns tablet, TI X 6, has been discussed at length by Godart et al.[53] Unfortunately, this tablet does not add a great deal to the present discussion because its contents are limited and much disputed.[54]

Where was Alum-Stone Found?

The discussion by Godart et al. re-iterates Chadwick's suggestion that *ku-pi-ri-jo* might have been a Cypriot trader importing goods from Cyprus into Messenia. However, it also opens up the suggestion that the alum could have originated from Melos. We have noted above that if *ku-pi-ri-jo* and *a3-ta-ro* are identified as blacksmiths, who roast alum-stone for the palace, then there is not a necessary requirement that the alum-stone had to originate on Cyprus. In that case, Melos does seem to be an obvious source of the alum-stone as it is within the Mycenaean region.

Shelford notes that alunite, i.e., alum-stone, occurs naturally on Melos in association with bentonite.[55] Pittinger informs us that, whilst there is no definitive proof that there was mining activity for bentonite substances in the Bronze Age, any such evidence would have almost certainly have been lost because of the extensive nature of subsequent mining activity. [56] More recently, during the Aghia Kyriaki, Melos Survey, alunite has been found in 'white rocks', which are composed mainly of kaolin and silica materials. Photos-Jones et al.[57] note that although alunite is found on Melos, no major deposits of alum itself have been found on the island; however, it is possible that the smaller alum deposits would have

represented a viable source for prehistoric peoples.

What was Alum Used For?

Finally, let us return to the question of what was alum used for. It has been suggested above that the imported volcanic earth was alum-stone and that this was roasted and broken into fragments to give alum. In principle, this alum could have been purified by dissolving it in water and separated by crystallisation. In practice, it is more likely that the roasted alum-stone was used directly as a mordant in dyeing. However, in the absence of archaeological evidence from Mycenaean Greece, this must remain speculation.

Notes

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1 Recent papers considering this subject include those written by Godart et al. 1979; Baumbach 1987; Franceschetti 1989; Perna 2005. In addition, there have been a number of significant contributions contained within wider discussions, see Himmelhoch 1990; Palmer 1994; Killen 1995.

2 *Kirk-Othmer Encyclopedia of Chemical Technology*, 2nd edition, Vol. 2, 58–65, 1963 and http://www.chempros.com/knowledgebase/albumin.htm.

3 http://www.chempros.com/knowledgebase/albumin.htm.

4 The taste is described as 'sweet' on http://www.chempros.com/knowledgebase/albumin.htm but 'sharp, astringent taste' by *Encyclopaedia Britannica*, vol. ix, 654, 1974.

5 Singer 1948, 21; see also Bailey 1932, 233.

6 Benton 1964 implies that bauxite can also be categorised as an alum. However, bauxite is not an alum, but is a mixture of hydrous aluminium oxides. (In particular, bauxite is not soluble in water.) This error was, in turn, quoted by Baumbach 1987, 53 and Palmer 1994, 92.

7 Levey 1958.

8 Singer 1948, xvii–xviii.

9 Pliny, *Nat. Hist*. 35.184. Pliny's writings on alum are sometimes not written clearly. For the purposes of the present paper, we have given these writings their most probable interpretation consistent with the scientific details that they are intended to convey, see Bailey 1932, 235f.

10 Bailey 1932, 233.

11 http://www.chempros.com/knowledgebase/albumin.htm.

12 For completeness, it is noted that the food additive E 521 is sodium aluminium sulphate (sodium alum) and E 523 is ammonium aluminium sulphate (ammonia alum). It is also worth noting that today, packages of potash alum carry a health warning that it is harmful if swallowed and irritating to eyes and skin. Aluminium sulphate is used as a coagulant to remove bacteria and suspended particulates from raw drinking water. There is some suggestion that there is a link between the residual levels of alum left in drinking water and Alzheimer's Disease.

13 Alum works as a mordant because the trivalent aluminium atoms form chemical bonds with both the dye-stuff and the textile. According to the page on mordants in http://stainsfile.info/, 'The attachment of mordants to dyes is by means of a covalent and a co-ordinate bond. This is otherwise known as *chelation*, and is a relatively common phenomenon. Stopping blood clotting by removing calcium ions is an example. The word *chelation* is apparently derived from the name of the large claw (*chela*) of a lobster. Gripping a metal atom by two different bonds has a fanciful similarity to gripping prey with two parts of this claw.'

14 *Nat. Hist.* 35.183.

15 Bailey 1932, 234.

16 *Nat. Hist.* 35.184–190.

17 *Nat. Hist.* 35.183–184.

18 Dioscorides V 123.

19 Gunther 1968, 642.

20 *Nat. Hist.* 36.143.

21 From the Leyden papyrus, translation provided by Hamed Abdel-reheem Ead (www.levity.com/alchemy/islam04.html). There is a difficulty with the text of paragraph 93 of the Leyden papyrus because of a transposition by the copyist. The above translation corrects that error: see Halleux 1981, 106 including footnotes.

22 Aulus Gellius, *The Attic Night 15.1*. Trans. John C. Rolfe, ed. Loeb Classical Library 1927. It is interesting to note that the use of alum as a fire retardant was not noted by Pliny. Herodotus (II.180) describes the sending of alum to Delphi by the Pharaoh Amasis of Egypt following the destruction by fire of the temple of Apollo in 548 BC. It is conventionally assumed that this was to be used as a fire retardant. However, there is no proof that this alum was intended to be used in this way. In the absence of international currency exchange, it might simply have been a gift of a valuable commodity which could be readily exchanged by the people of Delphi for the materials and labour required for the re-building of the temple: see the discussion by Baumbach 1987.

23 Levey 1958.

24 Nunn 1996, 161; Manniche 1989, 80.

25 Manniche 1989, 143, 150.

26 Intuitively, this might suggest that in earlier times the alum was less pure and people were less inclined to ingest it. As the process of purification by repeated re-crystallisation became known, the alum

would then have been more obviously a pure substance. However, this is just speculation.

27 Chadwick 1964.

28 Palmer 1965 states that the original suggestion came from Ventris. Palmer also discusses his objections to this interpretation.

29 Ruijgh 1967; Chantraine 1977, 1065, 1067.

30 From a linguistic point of view, it has been suggested (by J. Melena, private communication) that *tu-ru-pte-ri-ja / strupteria/* is clearly an adjective in *-ios* related to a feminine noun not expressed ('earth' most probably), functioning thus as a secondary noun. (It is not an agent, since a formation in *-tria* would have been expected.) So, *tu-ru-pte-ri-ja /strupteria/* is the earth usually used by a στρυπτηρ (a formation close to 'fuller's earth'). A στρυπτηρ is an agent noun in -τηρ built on a verbal stem **struph*, and the meaning would be 'squeezer' or something similar. *Stuph-* forms could be the result of a dissimilation from the former, when followed by suffixes with *-r-*, or simply a secondary association with στυφω.

31 Bennett & Olivier 1973, 57, suggest that the first three lines were written by Hand 3 but that the latter two lines were perhaps written by a different (unidentified) scribe. However, Palaima 1988, 68–70, does not suggest that An 35 was written by more than one scribe.

32 Palaima 1988, 68.

33 I.e., in grid-square 31, see Pluta 1998. However, note that An 35 is cut at the bottom.

34 But see Killen 1998 who suggests that *te-ko-to-na-pe* is a place name.

35 As suggested by Baumbach 1987, 53.

36 Baumbach also suggests that builders might have used alum as a mordant in dyeing, specifically for frescoes. However, she fails to note that almost all of the pigments used for fresco painting were inorganic and did not require a mordant. Recently Tyrian purple

has been found in Akrotiri frescoes but again no alum was used, Ann Brysbaert, private communication. See also Lang 1969, 229–230. This error was repeated by Himmelhoch 1990, 96. Theoretically it was possible that alum could have been used as an additive in plaster for waterproofing or for hardening (according to the list of properties given in Section 3). Therefore, it is also worth noting from Lang that the plaster that was submitted for examination from Pylos does not contain alum.

37 Palaima 1988, 72–73.

38 Based on an independent study of the find-spots of the Pylos tablets by the author.

39 Duhoux 1974.

40 Himmelhoch 1990.

41 Chadwick 1964.

42 Palmer 1965.

43 On both the Fh and Ga tablets, following Godart 1968.

44 Palaima 1991.

45 See also Chadwick 1976, 157–158.

46 See also Lindgren 1973, Vol. I, 33, 38 (note the typing error, *ai-wa-ro* for *ai-ta-ro*).

47 Note that the Theban place name that is spelt *a3-ki-a2-ri-ja* on Of 25 has the variant spelling, *a-ki-a2-ri-jo*, on Of 35. See Chadwick 1975, 95.

48 Each of the two tablets, Jn 320 and 415 includes a list of blacksmiths under a heading, which is a place name (*o-re-mo-a-ke-re-u* and *ru-ko-a2-ke-re-u-te*, respectively). According to Joanna Smith's interpretation, these place-names are in the northern half of the Hither Province of the kingdom of Pylos, see Smith 1993, 191.

49 At the Craven Seminar in Cambridge (May 2004), Evangelos

Kyriakidis noted that there were a large number of men's names which appeared both on the Cn-series and the Jn-series at Pylos, see also Smith 1993. Although he recognised that this may be fortuitous, Kyriakidis tentatively suggested that it may be due to the same men acting both as shepherds and as bronze-smiths. This suggestion would be consistent with the above, as roasting alum would represent an additional part-time activity.

50 As implied by Chadwick 1975, 158.

51 Although, in theory, it would have been possible to purify it by dissolving the alum in water and crystallising it, it does not seem reasonable to assume that this was implicit within the evidence we have from the Linear B tablets.

52 *Nat. Hist.* 36.143.

53 Godart et al. 1979.

54 In practical terms, the bucket-shaped container shown on the upper line (if it is accepted) might indicate the type of container used for transporting alum, although, of course, it is shown on a different line from the *tu-ru-pte-ri-ja,* and it might conceivably refer to a very different commodity.

55 Shelford 1982, 81. Bentonites are argillaceous rocks resulting from the hydrothermal alteration of volcanic material. The term bentonite is generally restricted to those volcanic rocks which have been transformed to a montmorillonitic clay, see Shelford 1982, 80. Fuller's earth is a form of calcium montmorillonite, see Pittinger 1975.

56 Pittinger 1975. It is interesting to note that the single Linear A tablet found at Phylakopi, Melos (MI 2) shows a 'bucket shaped' container (cf. TI X 6).

57 Photos-Jones et al. 1999.

22 Late Roman and Byzantine Linen Tunics in the Louvre Museum

by Roberta Cortopassi

The purpose of my recent study of Egyptian tunics was to show their technical features, rather than the iconography of their decorations. Of the 87 chosen pieces, including whole or almost whole tunics and large fragments,[1] *46 are in linen. Some of them come from Albert Gayet's excavations in Antinoopolis, but most are of unknown origin. The results of the analysis of the linen tunics are submitted here.*

Because of their date,[2] six linen pieces are not included in the following results, which are thus based on 40 items. The dating of tunics is a difficult matter, as usual with 'Coptic' textiles. However, eight of these 40 tunics have already been analyzed with radiocarbon dating method. The results range between the 5th and the end of the 7th centuries AD.[3] Only two pieces are older, probably from the 4th century, according to their plain, dark violet *clavi.*[4]

The ground weave[5] is always a tabby woven with single, S-spun, natural linen threads, but 27 are warp-faced, eight are balanced tabbies, and five are weft-faced.[6] Spinning and weaving quality is variable from piece to piece, but is uniform in a given piece of material. There is a minimum of 10 and a maximum of 42 warp threads, and a minimum of 9 and a maximum of 34 weft threads.

Starting and finishing borders have always cutout cloth or cut warp threads. If there are no seams or hems on sleeves or on the sides from the armpit to the waist, the warp threads are grouped (6 to 14 together) and tied with a single S-spun or with a 2S-spun, Z-plied natural linen thread, forming a short decorative fringe. On a single tunic, the tying thread is red wool and in another case, one warp thread ties the other warp threads of the same group. The knot used is always the same.[7] Next to the starting and finishing borders of most tunics, there are bands of bare warp threads on 0.5–1.5 cm after a few millimeters of tabby.[8]

All selvedges are plain. On three tunics, the two last warp threads are paired. The number of warp threads shows an increase of 20% to 100% for 1–1.5 cm next to the selvedges.[9] It is amazing that fringes are not inserted on the selvedges, since they are common not only on Pharaonic linen weaves but also on Byzantine wool tunics.

Thirty-eight tunics have a horizontal warp, only two have a vertical warp. However, the weaving method is known only for 30 pieces with horizontal warp: 14 were woven in one piece, 15 in three pieces and one in two pieces.[10] There are no technical or iconographic differences between the tunics woven in one piece and those woven in three pieces,[11] and their balanced number proves the contemporary use of wide and narrow looms. We can also note that for the tunics woven in three pieces, seven have short, woven-in *clavi*, but four have long, woven-in *clavi.*

A sewn tuck at the waist is used to join the three pieces of a tunic, but a sewn tuck is also inserted on 13 of the 14 tunics woven in one piece. On only two of them is the tuck still sewn: on the others, the stitches were carefully ripped during Antiquity, probably at the time of burial. The tuck shortened the tunic from 4 to 22 cm to fit the wearer.

Fig. 22.1: AF 5970, detail of the neck opening. © R. Cortopassi.

Fig. 22.2: AF 6032, sleeve from a child's tunic decorated with supplementary weft brocaded motifs and brocaded tapes. © R. Cortopassi.

Fig. 22.3: AF 12190, detail of the neck opening showing a silk samite sewn on the slit's selvedges. © R. Cortopassi.

All the 16 pieces with horizontal warp for which information is available were woven with sleeves; four of them have a tapering shape obtained with slanting seams. There is not a single example of a linen tunic woven without sleeves, at least in the Louvre

collection.

The neck opening is preserved on 30 pieces: 15 with a slit, 14 with cut and sewn cloth, one with a combination of both[12] (Fig. 22.1). Here again the two methods are well balanced. The neck opening with cutout and sewn cloth is used only on linen tabby, whereas there are no woven-in tapestry neckbands. The cut is straight on eight pieces and round on six. A decoration, tapestry or brocaded tape, is always sewn on a round cut. The slit opening is used on some linen tabby and on all the tunics with woven-in tapestry neckbands. Red or dark violet cords are sewn on the edges of the neck opening only if there is a tapestry decoration, woven-in or applied (eight items).

A number of tunics have self-bands on the whole weaving width (31 pieces) or only for 10–20 cm (14 pieces), or both. Actually, only two of the tunics with weft loops have no self-bands at all.[13] On the one hand, self-bands seem to be exclusively decorative. They are generally placed next to the borders (body and sleeves) or symmetrically on the chest, but in four cases they decorate the entire weave and are separated by 1.5 to 3 cm. On the other hand, there are weft twinings or *fausses tresses*[14] on nine pieces, and they are carefully used to reinforce the weave at the weak points (neck opening, armpits, and on both sides of tapestry *clavi)*. They, therefore, never run the whole width of the weave.

There are also ten tunics with tiny bands in dyed wool running in the weft direction for 10 to 15 cm. Some of them are woven in; some have been added after weaving. On nine cases the wool thread is red, in a single case it is green.

Four tunics have linen weft loops: two on the reverse, and two on the front and the reverse. All of them are weft-faced and of very good quality. One, with loops on the reverse only, is also decorated with patterned wefts in natural linen.[15] The three others[16] are ornamented with woven-in and applied tapestry elements with Z-spun wool wefts.[17]

The weft-faced tabby of two tunics is decorated with supplementary weft brocading, [18] an unusual technique on tunics (Fig. 22.2) .

Fig. 22.4: E 29309, detail of the woven-in tapestry decoration woven with S-spun wool wefts (bottom) and Z-spun wool wefts (top). © R. Cortopassi.

Tapestry, woven in or applied, is the most common decoration method followed by applied brocaded tapes. Indeed, woven-in tapestry occurs on 27 tunics, but on some of them another decoration has been added: five have also brocaded tapes, three applied tapestry, and one a silk samite sewn on the neck opening (Fig. 22.3).[19]

Of the 27 examples with woven-in tapestry 24 have crossed and grouped warp threads, two have alternating single and grouped warp threads plus floating warp threads on the reverse,[20] and only one has warp threads used singly.[21]

A third of the woven-in tapestry–9 case –were found to have Z-spun or Z-spun and S-spun wool wefts, which seems to be a very high rate for an imported material. In one case half of the tapestry was woven with a Z-spun weft and half with an S-spun weft (Fig. 22.4).[22]

Except for three pieces with bud motifs, all the tunics with woven-in tapestry have short (11) or long (13) *clavi*, which always match the shoulder ornamentation. Double sleeve bands are preserved on six pieces–only one has single sleeve bands.

There is applied tapestry ornamentation on ten tunics: five are woven-apart elements, and five are reused from worn-out tunics

(three with linen warp and two with wool warp).

Most of the stitching threads are 2 S-spun, Z-plied natural linen, with only a few exceptions: 3 S-spun, Z-plied natural linen (on three items), 2 S-spun, Z-plied red wool (on one item), 2 S-spun, Z-plied blue linen (on one item).

In conclusion it is interesting to note that the technique for making linen tunics is different from Pharaonic linen weaving, but it is even more different from contemporary wool tunics.[23] This seems to indicate a completely different weaving tradition, possibly of Hellenistic origin. It could be very interesting to compare the results of other museums' collections, since the group presented here comprised only 40 pieces.

Notes

I thank Marie-Hélène Rutschowscaya and Dominique Bénazeth, curators of the Coptic section, for encouraging this study.

1 Of course the choice was personal and therefore can be questioned. Since at least half of the fragments in the Louvre collection are from tunics, we chose only the pieces showing at least one technical indication (selvedges, borders, neck openings, etc.).

2 Three of them are probably Ptolemaic and three are much younger.

3 These ^{14}C analyses will be detailed in the forthcoming articles by Bénazeth 2005 and by Cortopassi 2004.

4 AF 5842 and E 29312.

5 For a glossary of technical terms used here, see De Moor 1993, 75–81.

6 The count of warp and weft threads is an average of the numbers found on different tabby spots for each piece, since they can change up to 10–15% on the same tunic.

7 See De Moor 1993, 96.

8 Bare warp thread bands are common on Pharaonic textiles. On

tunics, they have a decorative effect on sleeves, but make the weave fragile on the bodice, especially next to the seams.

9 This increase has been studied and experimented with on warp-weighted looms, but we do not know of any similar study on a vertical, two-beams loom, see Cooke & Hammarlund 2002.

10 The tunic woven in two pieces and the two tunics with vertical warp dressed the mummy of Thaïs, exhumed by Albert Gayet in the Antinoopolis necropolis; they have been recently identified by Calament 1996.

11 For example, tunics E 26108 and E 10130 are very close in their technical and stylistic features, but the first one is in one piece and the second in three pieces.

12 On tunic AF 5970, between the selvedges of the two tapestry neck bands, warp threads have been left bare on 2 cm, then they have been cut and sewn with buttonhole stitches.

13 AF 6040, E 26140.

14 One S twining next to one Z twining.

15 AF 6040.

16 AF 6250, E 26107, E 26140.

17 For tunics with loops on both the obverse and the reverse, see Cortopassi 2002 and Cortopassi 2004.

18 E 31973 and AF 6032. See Cortopassi 2002a , Nos. 1 and 2.

19 AF 12190. This is an unusual feature; another example with a silk application at the neck opening is kept in the Museu Téxtil of Terrassa 1999 No. 263, 155.

20 Theoretically, these two could have been woven on a warp-weighted loom according to Granger-Taylor 1993.

21 AF 6050 presents a coarse weave (counting 11 and 14) with bud motifs.

22 E 29309.

23 For example, the simple selvedges and borders of the linen tunics cannot be compared with the extremely sophisticated wool tunics.

23 Looped-Pile Textiles in the Benaki Museum (Athens)

by Sophia Tsourinaki

Dating from the 4th to the 8th centuries AD, the collection of Egyptian textiles in the Benaki Museum comprises 21 looped-pile textiles which display a variation in the techniques. Of special interest are the remains of a fine garment with pile on both sides of the fabric which illustrates the ancient Greek terms αμφίμαλλα, αμφίμιτα, αμφίταπα as well as attests to a rare type of vertical loom weaving. On the basis of the detailed analysis of textiles and actual experiments of looped-pile methods, an attempt will be made to determine more precisely whether three methods of pile formation can be distinguished. Moreover, a direct relationship between fabric characteristics and loom type may provide some practical suggestions for interpreting poorly documented data.

Comparative Study

The technique of weft looping is obtained by drawing a ground or a supplementary weft thread into short or long loops above the surface of the textile,[1] producing an effect similar to modern toweling (Fig. 23.1). These loops, used for ground fabrics or multicolored decoration, gave added thickness and warmth to various kinds of clothing (Fig. 23.2), household items and hangings (Figs. 23.3, 23.4) that might have been used in public and religious contexts. The first evidence of surviving textiles in Egypt comes from the Middle Kingdom. Linen weavers had learned to produce dense and sheer fabrics at will by using the warp-faced tabby and balanced weaves. However, these two common linen weaves are not conducive to pattern weaving, so special methods had to be

devised in order to make weft patterns.[2] Tapestry and looped-pile techniques were used for producing decoration, and denser and heavier cloths. The looping method occurs in several specimens of linen with a blanket pattern of looping, including the many towels used as winding sheets in the collective burial of 60 soldiers at Deir el-Bahri, associated with the 11th Dynasty Pharaoh Mentuhotep II (21st century BC).[3] At Lefkandi, Greece, an ankle-length linen tunic[4] was found in which the upper part was apparently produced by loops made by a weft yarn not run through the shed.[5] Fabrics with linen- and woolen-pile looping were excavated at Palmyra,[6] but at Gordion,[7] Dura-Europos, at-Tar Caves,[8] Xinjiang[9] and Nubia,[10] only woolen-pile fabrics were found. This attests to the gradual shift from linen to wool as well as an increase in textile coloration. The younger Pliny (d. 113 AD) called this shaggy material γαυσάπης,[11] and he believed it was first used for linen garments in his father's time. Texts and Byzantine papyri, alluding to the fleece-like texture, refer to the looped textiles as *μαλλωτά,*[12] *μαλλωτάρια, λινομαλλωτάρια, λάσια,*[13] and to the woolen-pile cloth as καυνάκης.[14] Correspondingly, the specialized workers who created pile clothing, covers and carpets were known as καυνακοποιοί. This pile method, by which naturalistic scenes were created through the use of colored woolen yarns, was closely connected to the method employed by the mosaicists[15] of the Late Antiquity period. Iconographic connections between looped weavings and mosaics can be observed in many cases.[16] The technique of looping with linen and woolen yarns was still widely used in the 6th and 7th centuries for the production of large hangings with Christian motifs (Fig. 23.5).

Fig. 23.1 : The technique of weft looping is obtained by supplementary wool wefts drawn into loops above the surface of the cloth and slipped

over a rod. Copyright and courtesy of Sophia Tsourinaki, Athens, 2004.

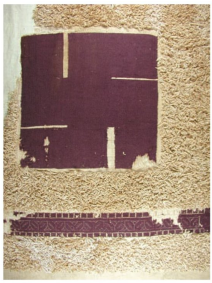


Fig. 23.2 : Fragment from an exceptional looped shawl with tapestry decoration. Linen and wool. Egypt, 4th century CE. Benaki Museum, Athens (acc. 7246). Copyright and courtesy of the Benaki Museum, Athens, 2004.

Fig. 23.3 : Fragment from a looped hanging with Heracles' tasks. On the left, Heracles is fighting a monster, a later representation of the Hydra of Lerna. On the right, Heracles is capturing the Ceryneian deer. Linen and wool. Egypt, 2nd–3rd century CE. Benaki Museum, Athens (acc. 7146). Copyright and courtesy of the Benaki Museum, Athens, 2004.

Fig. 23.4 : Looped square from a hanging with the personification of a River God. Linen and wool. Egypt, 4th–5th century CE. Benaki Museum, Athens (acc. 7180). Copyright and courtesy of the Benaki Museum, Athens, 2004.

Fig. 23.5 : Fragment from a looped Christian hanging with two standing figures in orants posture. Linen and wool. Egypt, 3rd–4th century CE. Benaki Museum, Athens (acc. 7145). Copyright and courtesy of the Benaki Museum, Athens, Hellas, 2004.

Textile	Ground weave	Warp material/proportion	Ground weft material/proportion	Supplementary weft thread	Method of pile formation	Selvedge	Other techniques
Acc. no 7146 Hanging with Heracle's tasks	warp-faced tabby	linen, S-spun, 17/cm	linen, S-spun, 10/cm	S-spun undyed linen, Z-spun wools	run through the shed	no selvedge	weft wrapping in details
Acc. no 7147 Hanging with Aratos	warp-faced tabby	linen, S-spun, 21/cm	linen, S-spun, 9/cm	S-spun wools	run through the shed	no selvedge	weft wrapping in details
Acc. no 7180 Rectangle with a River God	warp-faced tabby	linen, S-spun, 24/cm	linen, S-spun, 15/cm	S-spun undyed linen, S-spun wools	run through the shed	unreinforced selvedges	weft wrapping in details
Acc. no 7030 Fragment with a flying eros	warp-faced tabby	linen, S-spun, 19/cm	linen, S-spun, 10/cm	S-spun wools	run through the shed	no selvedge	weft wrapping in details
Acc. no 8494 Rectangle with a female allegory	warp-faced tabby	linen, S-spun, 22/cm	linen, S-spun, 12/cm	S-spun wools	run through the shed	no selvedge	weft wrapping in details
Acc. no 7145 Hanging with two orants	warp-faced tabby	linen, S-spun, 17/cm	linen, S-spun, 10/cm	S-spun undyed linen, S-spun wools	run through the shed	extra reinforced selvedges	weft wrapping in details, whipped fringe
Acc.no 7232 Fragments from hangings	warp-faced tabby	linen, S-spun, 18/cm	linen, S-spun, 5/cm	S-spun undyed linen, S-spun wools	run through the shed	no selvedge	weft wrapping in details
Acc. no 7117 Fragment from a hanging	warp-faced tabby	linen, S-spun, 9/cm	linen, S-spun, 5/cm	S-spun undyed linen, S-spun wools	Sehna knotted loops	no selvedge	weft wrapping in details
Acc. no 7139 Fragment from a hanging	warp-faced tabby	linen, S-spun, 25/cm	linen, S-spun, 7/cm	S-spun wools	Sehna knotted loops	no selvedge	weft wrapping in details
Acc. no 7026 Fragment from a hanging	warp-faced tabby	linen, S-spun, 25/cm	linen, S-spun, 13/cm	S-spun undyed linen, S-spun wools	Sehna knotted loops	no selvedge	weft wrapping in details
Acc. no 6995 Fragment from a hanging	warp-faced tabby	linen, S-spun, 16/cm	linen, S-spun, 5/cm	S-spun undyed linen, S-spun wools	Sehna knotted loops	left unreinforced selvedge	weft wrapping in details
Acc. no 7246 Shawl fragment	warp-faced tabby	linen, S-spun, 17/cm	linen, S-spun, 12/cm tap. wefts S-spun	S-spun undyed linen	run through the shed	one unreinforced selvedge	weft-faced tabby, tapestry, interlocked and dovetailed, hem stitching
Acc. no 7168 Looped medallion	warp-faced tabby	linen, S-spun, 19/cm	linen, S-spun, 10/cm	S-spun undyed linen, S-spun blue wool	run through the shed	no selvedge	weft wrapping in details
Acc. no 7161 Fragment from a looped weaving	warp-faced tabby	linen, S-spun 17/cm	linen, S-spun, 8/cm tap. wefts S-spun	S-spun undyed linen	Sehna knotted loops	right selvedge extra reinforced	weft wrapping in details
Acc. no 7247 Looped medallion	warp-faced tabby	linen, S-spun, 24/cm	linen, S-spun, 15/cm	S-spun undyed linen, S-spun wools	run through the shed	no selvedge	weft wrapping in details
Acc. no 7134 Fragment from a hanging	warp-faced tabby	linen, S-spun, 27/cm	linen, S-spun, 7/cm	S-spun wools	Sehna knotted loops	no selvedge	
Acc. no 32846 Fragment from a looped weave	tabby	linen, S-spun, 11/cm	linen, S-spun, 9/cm	S-spun undyed linen, S-spun wools	run through the shed	no selvedge	weft wrapping in details
Acc. no 7103 Fragment from a looped weaving	warp-faced tabby	linen, S-spun, 24/cm	linen, S-spun, 11/cm	S-spun undyed linen	Sehna knotted loops	portion of one unreinforced selvedge	
Acc. no 7149 Fragment from a looped weaving	weft-faced tabby	wool, S-spun, 7 pairs/cm	linen, S-spun, 36/cm tap. wefts S-spun	S-spun undyed linen	Sehna knotted loops	triple corded selvedges with additional weft	tapestry, slit and dovetailed, weft wrapping
Acc. no 7144 Fragment from a looped weaving	weft-faced tabby	wool, S-spun, 7 pairs/cm	linen, S-spun, 48/cm tap. wefts S-spun	S-spun undyed linen	Sehna knotted loops	triple corded selvedges with additional weft	tapestry, slit and dovetailed, weft wrapping
Acc. no 7068 Fragment from a looped weaving	warp-faced tabby	linen, S-spun, 35/cm	linen, S-spun, 10/cm tap. weft Z-spun wool	S-spun undyed linen	pile on both sides	no selvedge	repp rod process, slit tapestry, slanted weft, weft wrapping

Fig. 23.6: Table of study material.

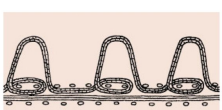


Fig. 23.7: The technique of weft looping is obtained by supplementary weft run through the shed. Copyright and courtesy of Sophia Tsourinaki, Athens, 2004.

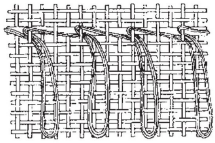


Fig. 23.8 : Fragment from a curtain with the looped decoration of a female allegory. Linen and wool. Egypt, 4th–5th century CE. Benaki Museum, Athens (acc. 8494). Copyright and courtesy of the Benaki Museum, Athens, 2004.

Fig. 23.9: The technique of weft looping is obtained by supplementary weft not run through the shed. Sehna knots are formed around one warp of the superior layer. Copyright and courtesy of Sophia Tsourinaki, Athens, 2004.

Fig. 23.10: The technique of weft looping is obtained by supplementary weft not run through the shed. Sehna knots are formed around one warp of the superior layer. Copyright and courtesy of Sophia Tsourinaki, Athens, 2004.

Fig. 23.11: Fragment from a looped Christian hanging with a standing figure in orant posture. Linen and wool. Egypt, 3rd–4th century CE. Benaki Museum, Athens (acc. 7134). Copyright and courtesy of the Benaki Museum, Athens, 2004.

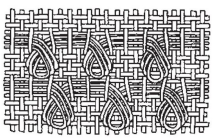


Fig. 23.12: Fragment from a looped weaving. Linen. Egypt, 5th–7th century CE. Benaki Museum, Athens (acc. 7103). Copyright and courtesy of the Benaki Museum, Athens, 2004.

In early times, the method of running a weft across a web seems to have depended upon the type of loom used and the fiber woven. R. Pfister, L. Berliner and D. De Jonghe[17] have put forward the hypothesis that the nature of the warp bears a direct relationship to the type of loom on which textiles are woven, and that the type of woven structure is characteristic not only of the different workshops, but also of the countries from which they originate. The underlying principle of all such discussions is that the hypothetical loom and method of weaving must be the simplest conceivable.[18] According to the characteristics of looped-pile textiles in the Benaki collection, I will present this matter by listing the pile types, describing each type, and finally, discussing the possible type of loom used. For the sake of clarity, much of the technical data has been put in table form (Fig. 23.6).

1. Pile made by an extra weft through the shed (Figs. 23.7 and 23.8)

The pile yarn was run sectionally through the shed and then pulled

forward between the warps to the face of the fabric. To ensure a uniform height, loops were presumably slipped over a rod or some other template, which was removed when the row was finished. After the pile was arranged, the linen main weft of the fabric was run through the same shed to back up the pile and to keep the web from spreading. The size of the textiles under discussion, the closely set-up warp ends, and the craft process, which does not require mechanical additions to the loom, suggest that a vertical loom with two warp beams was used. Another element supports this argument: on a vertical loom it is easier to execute tapestry decorations, as a larger part of the warp is within reach.

2. Pile made by an extra weft yarn not run through the shed (Figs. 23.9, 23.10 and 23.11)

The pile yarn was added to the material in the direction of the weft, as it was being woven, without passing through the weft shed. The weaver wound the thread around one or two warps from the superior layer. This process created a series of looped 'knots' and can be compared to the one used to make a *Sehna* knot. In Iraq, wool weavers worked it sheared, to imitate pile rugs. Past research has also suggested[19] that in Egypt, the technique, which apparently traveled along the trade routes from the Near East, had been used in connection with the horizontal loom with shafts. Actual attempts on my experimental loom, however, led me to assume that from a technical point of view, a vertical loom could also have been used. My experiments convinced me that on a vertical loom, rows of long loops made with continuous yarn (of 7 cm height as in Textile Inv. No. 7103, Fig. 23.12) could easily be drawn around my fingers (Fig. 23.13).

Fig. 23.13: Copyright and courtesy of Sophia Tsourinaki, Athens, 2004.

3. Pile on both sides of the textile run through the shed (Fig. 23.14)

Fragment Acc. No. 7068 is probably from a child's tunic. The elaborate decoration of the *clavus*, strongly influenced by the Hellenistic style of Late Antiquity, depicts fishes, birds and a lotus flower with a pot. The warp-faced tabby ground displays supplementary weft loops of different size and density on both sides of the fabric. Short (7 mm) and dense loops on the front and long (2 cm) and less dense loops on the reverse are formed by additional, double linen thread run through the shed. The remains of the ground weave reveal that the repp rod process was applied in the tapestry area (irregular repp weave) with a percentage of warps left floating on the reverse side. In terms of density of weave and careful execution, the fragment is a textile of exceptional quality. Pile on both sides of the textile and the different ways of looping enabled me to conclude that this type of pile formation was impossible to execute on a horizontal loom. For this textile, a vertical loom with two warp beams, a heddle rod, a tabby-shed rod, plus a repp rod for the tapestry area, was used. The crossing of the warp for the tapestry decoration (Fig. 23.15) supports the above-mentioned assumption. Two weavers would have worked together, one on each side of the cloth, and two sizes of rods would have been used, determining the different height of the pile. The master weaver would have faced the front side of the tapestry, as the irregular repp weave with floating warps facing the weaver would not only affect the visibility of the motifs, but also hide the weaving. The few examples of textiles with pile on both sides within museum collections[20] provide evidence that they were produced by a famous workshop or were the result of a distinguished weaving tradition. This rare and time-consuming method of pile formation justifies the ancient Greek terms *ἀμφίμαλλα, ἀμφίμιτα, ἀμφιδασέα.*[21]

Fig. 23.14: Fragment from a looped tunic with pile on both sides and a

tapestry clavus depicting birds, a fish and a lotus pot. Linen and wool. Egypt, 4th–5th century CE. Benaki Museum, Athens (acc. 7068). Copyright and courtesy of the Benaki Museum, Athens, 2004.

Fig. 23.15: The tapestry decoration is woven over alternate grouped warps, irregular repp weave, 10–11 g warp/cm. Linen and wool. Egypt, 4th–5th century CE. Benaki Museum, Athens (acc. 7068). Copyright and courtesy of the Benaki Museum, Athens, 2004.

The considerable care that went into the technique of weft looping indicates that weaving was still a highly skilled craft in Late Antiquity. In Egypt, a center for linen weaving, it was still widely employed during the Roman and Byzantine periods and used to produce several types of fabrics.

An analysis of looped textiles in the Benaki collection shows that they fall into three groups according to the pile method used. Moreover, the structural differences between textiles correspond to particular categories that share common technical and iconographic systems. The first category (18 textiles) is characterized by closely set-up warp ends and a warp-faced tabby structure woven onto a linen S-spun warp. The second group (2 textiles) displays a weft-faced tabby structure on a paired, woolen, S-spun warp, with triple-corded selvedges with additional wefts and tapestry bands across the width of the fabric (Fig. 23.16). The third group, with one fragment, shows the typical characteristics of fine textiles with pile on both sides of the fabric. Woven in warp-faced tabby structure on a linen S-spun warp, it has pile run through the shed and tapestry decoration in Z-spun wool. Ground weaves of the three groups have different thread counts, which vary from a low to a considerably high density and are indicative of quality. Preserved selvedges show that looms of different width were used. Technical characteristics (closely set-up warp ends, methods of pile formation and crossed warps) seem to require no more than a two-harness vertical loom. A

study of looped-pile textiles in museum collections will provide further evidence for this theory.22

Fig. 23.16: Fragment from a looped coverlet (?) with rows of Sehna knots and a tapestry band. Linen and wool. Egypt, 4th–5th century CE. Benaki Museum, Athens (acc. 7144). Copyright and courtesy of the Benaki Museum, Athens, 2004.

Notes

1 For an introduction to the looped-pile techniques, see Bellinger 1955.

2 Bellinger 1957.

3 Winlock 1945, 206.

4 Barber 1991, 197.

5 My thanks to Peter Kalligas for allowing me to inspect this garment in the laboratory of the National Museum, Athens. For the excavated material, see Popham et al. 1982, 169–74.

6 For selected bibliography, see Pfister & Bellinger 1945; Pfister 1934.

7 Bellinger 1962.

8 Fujii et al. 1982–1983; Fujii & Sakamoto 1992.

9 Wu 1996.

10 Loops in these pile fabrics were probably sheared and the pile resembled originally that of the true knotted rugs. For the

excavated material, see Bergman 1975. For several looped-pile examples from Qasr Ibrim, see Adams 1988, 748–754, Pl. VII, IX.

11 Pliny, *Natural History*. VIII. 74: ‘Gausapae patris mei memoria coepere, amphimalla nostra, sicut villosa etiam ventralia nam tunica lati clavi modum gausape texi nune primum incipit.’

12 Roberts 1950, 101–102. Also, Πολυδεύκης, Ὀνο*μαστικόν*, Z. 57. “Πλάτων δὲ ἐν ταῖς ἀφ’ ἱερῶν καὶ μαλλωτὰς χλανίδας εἴρηκεν, ὥστε οὐδὲν ἂν κωλύει εἰπεῖν καὶ μαλλωτὸν χιτώνα”.

13 Πολυδεύκης, Ὀνο*μαστικόν*, Z. 74. “Λάσιον ἐπιβεβλημένος, οὕτω δὲ καὶ νῦν καλοῦσι τὰ μαλλοὺς ἔχοντα χειρόμακτρα ὡς ἀπὸ τῆς δασύτητος, ὥστ’ οὐδέν ἂν κωλῦοι τὰς ὀνομαζομένας μαντήλας οὕτω καλεῖν”.

14 Wipszycka 1965, 115. For the origin of this looping method, which according to Aristophanes lies in Babylon, see Ἀριστοφάνης, Σφῆκες, 1131.

15 Stauffer 1995.

16 An outstanding example is the rug or cover (Inv. No. 89.18.43) in the Metropolitan Museum of Art, New York, which can be directly juxtaposed with a pavement from Missi-Mopsuhestia in Cilicia in Turkey.

17 On this topic, see De Jonghe et al. 1999.

18 Wild 1987, 459–471.

19 For two draw-loom pieces Cat. Nos. 110–11, see Trilling 1982.

20 For a complete tunic, see Wolff & Volbach 1926, Pl. 73. Also, parallel fragmented tunics with pile on both sides are in the Folk Art Museum, Athens (Inv. No. 676), Louvre Museum, Paris (Inv. No. E 26107 and AF 6256) and the Metropolitan Museum of Art, New York (Inv. No. 26.9.6.). According to R. Cortopassi, they display very short loops on the right side of the garment, longer ones on the inside and tapestry decorations using Z-spun colored wools. For details on this topic, see Cortopassi 2002.

21 For a detailed study on these terms, see Αποστολάκι 1932, 24–28; Αποστολάκι 1948. Πολυδεύκης, Ὀνομαστικόν, Z. 57: ‘Τὸ δὲ ὕφαδρον ἱμάτιον παχείαν χλαῖναν κλητέον καὶ σίσυν, ὥσπερ τὸν ἀμφίμαλλον χιτώνα δασὺν καὶ ἀμφίμιτον’.

22 See Tsourinaki 2005.

24 A Medieval Georgian Textile in the Benaki Museum (Athens): the *Sakkos* of the Antiochene Patriarch with Georgian Embroidery

by Irine Nikoleishvili and Eliso Akhvlediani

The author's attention was drawn to the short-sleeved sakkos of the Patriarch of Antioch Silvestros now in the Benaki Museum, Athens (No. 33708). It is a red Persian silk textile woven with gold thread and brocaded with a diaper foliate pattern picked out with a floral spray, edged with gold lace. Stitched on to the neck and the back is a Georgian ecclesiastical embroidery with a Georgian inscription. Originally the embroidery formed part of the phelonion made on the order of Revaz Endronikashvili (Andronikashvili) who was superintendent of police and manager of the Kiziqi region (of Georgia) in 1665–1670. He donated this embroidery to the 'Sagaredjo desert' (5th to 17th centuries David-Gareja cave monasteries group, eastern part of Georgia). Subsequently–owing to its damage or for some other considerations–it was used as a decorative embellishment on the sakkos of the Antiochene Patriarch. The Georgian embroidered inscription gives a clear indication of the date of donation–1702 AD.

A great number of specimens of medieval Georgian Christian art are scattered in many countries of the world. The bulk of them belongs to major museums or private collections. Some of them are preserved at Orthodox monastic centers (Jerusalem, Sinai, Athos,

etc.). The study of these specimens will be helpful for the reconstruction of a general picture of Georgian medieval art history, and it will also shed some light on historical processes, ecclesiastical or political events. Notably enough, these unique remains of medieval Georgian Christian art for various reasons have only recently become the objects of study.

In September 1999 an exhibition entitled 'Amphia–Vestments of the Eastern Orthodox Church'[1] was held at the Benaki Museum, Athens. One hundred nine sacerdotal vestments (the *sticharion*, the *sakkos*, the *omophorion*, the *epitrachelion*, the mantle, the *phelonion*, the *epigonation* (genual), the *epimanikia* (maniples)) were presented in the exhibition. The *sakkos* of the Patriarch from the collections of the Benaki Museum (No. 33708) claimed our attention. According to the catalogue of the exhibition, it belonged to the Patriarch of Antioch, Silvestros, from Argyroupolis of Pontos, when he took over the Holy See of Chaldia and Cheran.[2] This *sakkos* is a magnificent piece of Christian culture. It is decorated with embroidery bearing a Georgian *asomtavruli* inscription stitched on front and back. The catalogue indicates the Georgian origin of the inscription, but it lacks any specification. The *sakkos* of the Patriarch of Antioch adorned with an inscription in the Georgian *asomtavruli* script, preserved in the collections of the Benaki Museum, naturally raises many questions about its history.

Fig. 24.1: The sakkos, front. (Copyright: Benaki Museum, Athens, Greece).

Fig. 24.2: The sakkos, back. (Copyright: Benaki Museum, Athens, Greece).

Fig. 24.3: The sakkos, back, 'Deesis, of 1702'. (Copyright: Benaki Museum, Athens, Greece).

Fig. 24.4: The sakkos, front, 'saintly fathers (priests), of 1702'. (Copyright: Benaki Museum, Athens, Greece).

The *sakkos* is made from Persian patterned silk (Figs. 24.1 and 24.2). It has short sleeves. A gold-embroidered band (hem) fastens open sections at its sides. The sides of the garment are adorned with small gold bells. Its length reaches 120 cm, and the width, 108 cm. The lower corners of the *sakkos* are decorated with ornamental rosettes of fine needlework. The vestment is bordered around the neck by an embroidered fragment of pink silk textile. As mentioned above, the embroidery on the *sakkos* is represented in two parts–on the back and the chest. The composition of the embroidery is shown in two registers of consecutively placed figural representations. Close inspection shows that a number of figures in the composition were cut out and removed. The design of the composition is represented in two registers for both the '*Deesis*' and the row of saintly fathers (Figs. 24.3 and 24.4). The upper register on the backside shows the '*Deesis*', a knee-length representation of the Savior. Christ is depicted in frontal pose, blessing with both hands. To his right, the Virgin is shown in a three-quarter turn, with a gesture of prayer addressed to the Savior. The Virgin is flanked by the figure of St. Peter (only half of whom is discernible). The apostle is represented holding a key and reaching out his hand in prayer. To Christ's left, the figure of St. John the Baptist is portrayed also in a three-quarter turn, in a prayer pose.

The lower register shows figures of saintly fathers, holding books in their hands. Three of them are represented with their hands near their chests in blessing, the fourth figure with his hands stretched out is also shown making a blessing and holding a book in his hand.

Inscriptions accompany the figures of both the upper and the lower registers. They are embroidered in silver thread in the Greek language: Jesus Christ, the Virgin, St. Peter, St. John the Baptist, St. Nicholas, St. Basil, St. Gregory and St. John. The upper row of the embroidery sewn onto the chest bears a small part of the garment of a figure, probably St. Paul.

To the right and left on the embroidery on the front, two pairs of evangelists are shown turned three-quarters, holding gospel books in their hands. Pairs of saintly fathers in similar poses on the back are represented in the lower register. Unlike the composition on the back, no inscriptions accompany these figures. As noted, a Georgian *asomtavruli* inscription borders the embroidery, embroidered in black silk thread.

As is known, a vestment embroidered with iconograpic scenes from the christological subjects usually bears a canonical and donor's inscriptions. Professor Mackelein from Berlin deciphered the inscription found on the *sakkos* in Athens. It is noted in the catalogue published in 1913 that the academician Nicholas Marr provided reports on the historical persons mentioned in the inscription to the researcher.[3]

The Georgian *asomtavruli* inscription undoubtedly surrounded the above-mentioned composition entirely, completing and enclosing it as if in a frame. The text embroidered on a gold ground in black silk, although damaged, is still fairly legible. The letters are clearly outlined on the fabric, their shape and treatment follows the principle of decorative ornamentation. The letters are interlaced in an impressive and well-considered manner. Apparently this object had had quite a different function; later on it was cut into pieces and stitched onto the newly made *sakkos* of the Patriarch. During the stitching it was bordered by a hem: when fringing the collar several figures of the composition were cut off or out, and fairly numerous groups of letters of the inscription were left out. Due to the alteration of the embroidery, the restoration of the entire content of the inscription proves a little difficult at this stage. It follows, however, a traditional, elaborated model of dedicatory and donor's text:

I, Revaz Endronikashvili, *mouravi* of Kiziqi ordered

this *phelonion* to be sewn, and donated it to you, the Georgian Monastery of St. John the Baptist in the holy Desert of Sagarejo, seeking your protection and for the salvation of my soul. Koronikon ‘TJ’ (Figs. 24.5 and 24.6)

Fig. 24.5: The phelonion, the inscription of 1702 in the Georgian alphabet ‘Nuskhuri’. (Copyright: Benaki Museum, Athens, Greece).

Fig. 24.6: The phelonion, the inscription of 1702 in the Georgian alphabet ‘Nuskhuri’. (Copyright: Benaki Museum, Athens, Greece).

Despite this defect, the inscription with its content, the correct language, the rhythmic organization and the beauty of execution, puts it among noteworthy specimens of Georgian epigraphic remains. It is interesting from the viewpoint of paleography and for its symbolic value. The inscription contains very significant evidence. I shall offer an overview of the evidence provided by the inscription, and also touch upon interesting historical matters.

We learn from the Georgian inscription that initially a *phelonion*, which is clearly discernible, was sewn on the order of *mouravi* (manager) Revaz Endronikashvili, who entrusted it to the Desert of Sagarejo for its protection. Georgian historical documents have preserved reports about Revaz Andronikashvili (1665–1700).[4] He occupied the post of *bokaultukhutsesi* (superintendent of the police) in 1696–1700. He was the manager of Kiziqi. Along with the bishops and nobles of Kakheti, he approved the exemption of serfs of the David Gareja Monastery from taxes (1696). Revaz Andronikashvili took part in the distribution of serfs and lands, determined the duties for the Monastery of St. Nino at Bodbe (1700), and also settled land disputes between the residents of

Kakabeti and Shibliani (1700).

The inscription brings to light not only the identity of the donor, but also the place and date of the donation: the desert of Sagarejo, i.e., the Monastery of St. John the Baptist in the Desert of David Gareja, and Koronikon 'TJ' (i.e., 1701).

At that time the *phelonion* commissioned by Revaz Endronikashvili (Andronikashvili) seems to have been donated to the Monastery of the Gareja Desert in compliance with the rules. It can be assumed that later Revaz Andronikashvili himself could have been buried in the same monastery. This hypothesis is based on the document of 1780, according to which the spouse of Prince Giorgi, daughter of the manager of Kiziqi, Ketevan Andronikashvili, was buried in the David Gareja Monastery. Prince Giorgi committed himself thereafter to donate annually three packs of wine from the gardens of his patrimony at Akhmeta to the monastery.[5]

The *asomtavruli* inscription appears as an integral part of the embroidery, simultaneously bordering the composition and making it more conspicuous. Proceeding from the content of the inscription, such jumbling of the composition and removal of a number of figures become understandable, for according to the inscription, the embroidery had initially been a *phelonion*.

The *phelonion* was a bell-shaped, sleeveless outer garment, sewn from a long, square fabric, with a single opening for the head. It was a vestment worn on both shoulders by clerics of the episcopal and priestly order. Christ himself and the apostles wore the *phelonion*. Originally it was white, as a symbol of divine light. In the 14th–15th centuries, the *phelonion* covered the entire body from the neck to the feet.

At first glance, the placement of fragments of the embroidery on the *sakkos* did not destroy the compositional unity of this vestment. The embroidery merged completely with the decoration of the garment. But this is so only at first glance. A closer examination demonstrates that the symbolic representation of the vestment and the rhythm of arrangement of the figures on the embroidery, respectively, are destroyed, failing to meet the requirement associated with the composition designed for the *phelonion*. Therefore, the composition shown on the embroidery is cut in two places, and according to the needs of the upper part of the *sakkos*, is

represented in three parts. One whole part was sewn onto the back, and two comparatively smaller ones were stitched at the chest near the neck.

The redaction of the '*Deesis*' composition depicted on the embroidery must have been borrowed from compositions of the icons or wall paintings of the later period. This applies first of all to the iconography of St. John the Baptist. St. John is shown with wings, as 'an angel of the desert'. Such representation of St. John is acceptable for the iconography of the Orthodox world (Greek, Serbian, Russian, Georgian, etc.), and is encountered in wall paintings and icons from the end of the 14th century. Along with this, the figure of Christ is represented in an untraditional manner, spreading both hands in blessing. In earlier specimens, the Savior was represented making a blessing with his right hand and holding an open book (or a scroll) in the other, enthroned or standing, shown full- or half-bodied. Such representations of the Savior are found in the examples of early medieval Georgian wall painting (Zemo Krikhi, Nakipari, Matskhvarishi, Pavnisi).[6] The study of specimens of medieval embroidery demonstrates that their makers always drew models from some pre-existing source. Probably, the iconographic design of the '*Deesis*' was borrowed from an elaborated model.

If we reconstruct the given composition of the *Deesis* on the *sakkos*, the original design of the arrangement of the figures must have been as follows: the figure of the Savior stands out in the center, flanked by the Holy Virgin and St. John the Baptist to the right, and to the left, St. Peter, next to the Virgin. St. John must have been flanked by the figure of St. Paul, the end of whose dress is discernible at the neck of the *sakkos* in the first register. Next to him, two evangelists are represented with a three-quarter turn to the center. On St. Peter's side there are two more figures of evangelists. The lower register portrays eight, or maybe nine figures of saintly fathers. The isolation of the figures of St. John Chrysostom, St. Basil, St. Gregory and St. Nicholas from the general pattern by inscriptions and their placement in the center point to their role as the founders of Byzantine theology.

In the creation of the color gamut of the embroidery, the master had to keep in mind certain tradition and canons. The canons prescribed that embroidery must have a rich, festive look, hence the

use of costly material. From the 17th century in Georgia, intense use was made of gold and silver thread, or gold wire (twisted on silk). Gold thread was stretched over the embroidery. The use of this material, gold and silver thread in the embroidery, resulted in luxurious effects, which was required by the canons.

The composition of the '*Deesis*' is embroidered in gold thread, gold wire, and black and pink silk thread. The embroidery is executed in gold thread on yellow fabric. Gold and silver colors were employed more frequently in Georgian embroidery from the 17th century. The colors merge with the ground, resulting in a single, shining mass. The given embroidery is very close to the specimens of goldworking (icons). The composition according to the distribution of the figures and the construction is executed in conformity with the typical rules of icon painting. The choice of the tones and their matching with the gold thread show the refined taste of the embroiderer. The brilliance of gold and silver threads is fully revealed. Crucial importance is attached to the ground. A gold ground is pure Byzantine coloring, full of inner intensity, adding to the impression of flatness. The figures are clearly outlined. The closed, serene outline of Christ's figure matches well with his quiet pose. The monumentality of the composition is achieved in the small sizes of the figures. The garments and hair are treated in a linear-decorative manner. The hair is shown by a simple technique–divided into bands or crimped at places (see the figures of St. John and St. Nicholas). The decorative function of the linearity is obvious in the rendering of the surface of the garments and the pattern of the dress (see the figures of saintly fathers). A characteristic feature deriving from the specificity of embroidery technique should also be taken into account–the composition is plane-and-graphic. The flat treatment of the figures and the slightly contorted proportions indicate the similarities to specimens of late painting. In this respect as well, the Georgian embroidery preserved at the Benaki Museum bears resemblance to the remains of the 16th-17th centuries Georgian embroidery.

The Mravalmta Complex of the Gareja Desert is a major ecclesiastical and cultural center in Georgia. It was founded in the 6th century by one of the 'Thirteen Syrian Fathers', David of Gareja. The monastic complex was cut out of the rock, becoming increasingly beautiful. Its patrons were Georgian nobles, which is

attested by historical documents. Georgian clerics and laymen showed particular respect to this complex in the subsequent centuries too, where numerous magnificent monastic complexes and specimens of medieval wall-painting have survived. Many manuscript books significant for Georgian culture were copied and illuminated at these abodes. Some of them have come down to us. Many Georgian Orthodox Christians felt an obligation to donate gifts to the Gareja Desert–kings, queens, the gentry, clerics and common folk made their contributions to the decoration of the complex in the Gareja Desert.

Due to its location, Georgia always suffered invasions by her neighbors, Iranian, Turkish and northern Caucasian Muslims. Many cities, settlements and churches were ravaged and burned. But the Georgians always tried to rebuild. Numerous items of Georgian culture were scattered during these invasions, finding their way later on to various museums and treasure-houses of the world. The Gareja Monastery suffered one such final devastation at the beginning of the 17th century, during a raid organized against Georgia by Shah Abbas of Iran, on a Great Feast–Easter Day. Many monks were killed and the monasteries were ravaged and looted.[7] It is highly probable that the *phelonion* donated by Revaz Andronikashvili to the Monastery of St. John the Baptist at Gareja fell into the hands of robbers at exactly that time, the embroidery being redeemed later in the Orthodox Church of Antioch. The damaged item was re-used. The embroidery decorated with the christological subjects was employed as the décor of the *sakkos*, retaining almost completely the data of the content and dates of the inscription, showing genuine respect to an Orthodox object. The item relates the fate that has befallen it.

Fig. 24.7 : The omophorion from the Tsaishi church (Georgia), the embroidery with figures of church fathers with an inscription from 1312 in the Georgian alphabet 'Nuskhuri'. (Copyright: Georgian State Art Museum, Tbilisi, Georgia).

Fig. 24.8 : The omophorion from the Tsaishi church (Georgia), the inscription of 1652. In the Georgian alphabet 'Nuskhuri'. (Copyright: Zugdidi Historical Museum, Zugdidi, Georgia).

Similar stories are encountered in other specimens of Georgian medieval art. In this respect, the *omophorion* preserved at Tsaishi (Fig. 24.7), Georgia, can serve as a parallel. Along with embroidered figural images, this vestment bears inscriptions relating its history. Originally, in 1312, a member of the family of big feudal lords of Southern Georgia, Tamar Kherkhemlidze, embroidered an *epitrachelion* and donated it to the Anchi Monastery

(southern Georgia, the northern part of present-day Turkey). In 1358–60 Queen of Queens Natela Jaqeli altered the *epitrachelion* into an *omophorion*, placing an inscription reflecting this event and adorning the garment with tassels of gold thread. The *omophorion* seems to have been damaged, for in 1652, Bishop David (Jolia) of the Tsaishi Monastery (Western Georgia), redeemed the damaged *omophorion* from the Turks, whereupon his sister, nun Tamar, restored and donated it to the Tsaishi Monastery (Fig. 24.8). At present this *omophorion* is preserved at the Georgian State Museum of Art, in Tbilisi. Part of this *omophorion* with a 1312 inscription is preserved in the Zugdidi Historical Museum, Georgia.

Notes

We would like to thank Ms. Bitsa Tsikoma, the librarian at the Benaki Museum, for her kind help in the preparation of our research. We would like to thank also Dr. George Otkhmezuri for his valuable comments on interpretation of the *Sakkos* Georgian text.

1 '*Amphia. Vestments of the Eastern Orthodox Church*', Benaki Museum. 1–30 September 1999 (Catalogue of exhibition). Athens, Benaki Museum. 1999, 11–12.

2 Theochari 1986, 123; Ginzel 1911, Vol. 3, 317, 410.

3 Theochari 1986, 46.

4 Dolidze 1965, vol. 2.

5 Pourtseladze (ed.) 1881, 76.

6 Amiranashvili 1963, 304–305; Virsaladze 1963, 107–166; Aladashvili et al. 1983, 77–101; Virsaladze 1955, 169–232; Privalova 1977; Mamaiashvili 1991, 30–32.

7 *Sakartvelos istoriis tskaroebi* (Sources of Georgian History),Vol. 5, 1970 (in Georgian).

25 The Llangorse Textile: Approaches to Understanding an Early Medieval Masterpiece

by Louise Mumford, Heather Prosser and Julie Taylor

A charred, waterlogged, 10th-century textile from Llangorse, Wales, has been unfolded and conserved. It has proved to be part of a garment, the upper parts of which are decorated in a unique manner. This contribution describes the strategies being used to record and publish the textile, and the experimental work in progress on the techniques which may have been used to produce the minute decoration. The work is a collaboration between a conservator (Mumford), an embroiderer (Taylor), both of the National Museum of Wales, and an archaeologist, weaver and dyer (Prosser), who undertook the research for her undergraduate dissertation.[1]

Conservation and Recording by Louise Mumford

The Llangorse Textile was found during excavation of the crannog or man-made island in Llangorse Lake, near Brecon in southeast Wales.[2] The crannog is believed to have been constructed by the ruler of the early medieval kingdom of Brycheiniog in the AD 890s, and destroyed by fire early in the 10th century

Description

The textile was preserved in waterlogged silts, resting partly on a piece of charred wood. The blackened fabric formed a compact lump approximately 22 × 13.5 × 6.5 cm, and was taken to the

conservation laboratory of the Department of Archaeology & Numismatics, National Museum of Wales in Cardiff for conservation.[3]

Initial cleaning revealed that the surface of parts of the textile is patterned, the ground textile being entirely covered with stitches. The stitches in the design and the background are worked at right angles to each other, and at intervals the design and the direction of the stitches reverse. The stitches are staggered by one thread in each row, giving a twill effect. The ground textile has 25 threads per cm in both systems.

The designs are worked in two-ply thread, and the background filled in with glossy, single-ply stitching. This has been described as 'stem stitch on counted threads…The embroidery thread follows the structure of the tabby-woven cloth, passing over two warp or weft threads and wrapping back under where the warp and weft intersect.'[4] (Fig. 25.1).

Conservation

The textile was uniformly black, and the fibres remained black and opaque under the light microscope even after bleaching, indicating that they were charred. Examination under the Scanning Electron Microscope revealed that the pattern and sewing threads were of silk, whilst the threads in the ground textile were composed of bast fibres, whose diameter suggested that they might be linen. Fourier-Transform Infrared Spectroscopy of the fibres failed to find any traces of dyestuffs.

Although fragile, the fabric was flexible when wet, and the individual layers were separated, cleaned and air-dried. The conserved textile is brittle and fragile, experiments having failed to find a consolidant which did not obscure the fine detail. There is approximately 780 square cm of patterned fabric, and almost twice as much of unpatterned tabby linen.[5]

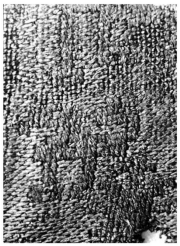


Fig. 25.1: Pattern and background stitching

Recording

Before drying, each patterned fragment of the textile was photographed at high magnification in a raking light, to create 6× photomontages, on which the stitches are clearly visible. The photomontages were used to provide a preliminary outline of the overall design and are currently being used, in combination with the textile itself, to draw a stitch plan of the design (25.2).

This is a work in progress, and only a small area has been recorded in this way. The magnified photographs can also be used to produce computer-simulated images with conjectural colour, and it is hoped to publish both a stitch plan and magnified photographic record of the design.

Design and Construction

A belt loop suggests that the textile was a garment, predominantly of tabby linen but with panels of decorative stitching. The decorated part, which has a triangular gore inserted into it, may be from the upper part of the garment. The design includes lions, ducks, and other creatures in a framework of vine stems, with leaves and bunches of grapes, and the design, together with the direction of decorative stitching, changes to a reversed image both vertically and horizontally in the main design, and with each motif in the lion border. The seams are covered with tiny braids, known as sennits, which are strengthened where they meet with triangular motifs; another sennit is found at the bottom of the hem.

Experimental Work

During the recording process, it was noticed that the stitching was extremely accurate, with no split or misplaced stitches. The the mathematical correctness of the stitch plan suggested that the textile might have been woven rather than embroidered. If embroidered, it was not clear how the stitching was executed, since the reverse of the patterned pieces is rarely accessible, being lined with linen to which it has been attached by stitching at intervals. Where it is visible it is difficult to interpret: therefore, using the stitch plan of part of the lion border, both woven and embroidered replicas were produced in an attempt to discover in which way it had been made.

Fig. 25.2: All decorated pieces, with design outlined in white.

Embroidered Interpretation of Llangorse Textile, by Julie Taylor

Materials

Tabby-weave loom-state linen ground, 56 count.

Silk embroidery thread, two-ply. It was not possible to source single-strand silk thread for this project.

Embroidery frame.

Embroidery needle.

Method

Sample 1: Red lion on green background

Initial stem stitch technique was found to be incorrect, as threads crossed the line of stitching but were not parallel to it. The exercise proved valuable, however, in deciding that the most comfortable way to stitch this design was in individual panels. The lions were stitched from top to bottom (first) and the background from right to left (second).

Sample 2: Red lion on gold background

The brown border line was worked first in satin stitch over two threads. The lion panels were then worked individually in stem stitch, stitched similarly to half cross stitch, first the lion then the background, before moving on to the next lion. The lions were worked top to bottom; the background right to left.

Problems Encountered in Sample 2

When carrying out counted thread stitching on even-weave (as opposed to block-weave) fabrics, there is a danger of the working thread slipping out of place into the adjacent hole. The reason for this is that if the working thread crosses only one ground thread in either a vertical or a horizontal direction, it will be pulled between the warp and weft threads of the ground, when it matches the weave of the ground. This causes gaps in the embroidery and was very obvious when inspecting the reverse of the red and gold sample under the microscope. No such gaps have so far been noticed in the Llangorse textile.

Gaps in half cross stitch due to thread slippage

Stitches for counted thread work are for this reason always carefully selected to ensure that slippage does not occur.

During the stem stitch itself, the working threads crossed the ground diagonally, and sat where they were placed. When changing direction at the end of the row, however, the working thread crosses a single thread of the ground either vertically or horizontally, and occasionally it is pulled out of place as it matches the weave of the ground at this point. Changing the starting point of the motif meant only that the slipping stitches occurred at a different point in the embroidery. The only option available was to use a different stitch, either at just the end of the rows or throughout the whole embroidery.

Sample 3: Green lion on orange background

The green and orange sample was stitched using this alternative stitch. The face of the stitch appears identical to stem stitch, but the reverse crosses either 2 or 4 threads of ground instead of 1 or 2. At the end of rows it never crosses only 1 thread, and therefore cannot slip. It is stitched similarly to tent stitch. The needle is brought up 2 threads into the line, and inserted 2 threads back and 1 down, at the start of the row. It is then brought up 2 threads past the original point, and inserted 3 threads back and 1 down. This variation solved the problem of slipped threads, and having the threads travel a longer distance on the reverse helped the stitches sit more evenly. Unfortunately, this sample did not agree with microscopic examination of the archaeological fragment. In addition, it used much more silk thread.

Sample 4: Brown lion on gold background

Here, ordinary stem stitch was used for the majority of the work, and the reversed stitch used at the turn of the rows to avoid the slipped stitches. This was suggested by noticing a column of slightly longer stitches on the reverse of the original, in the midst of the

shorter stitches and trailing threads (Fig. 25.3).

Time Taken

After practice, each lion motif took about ninety minutes to complete.

Woven Interpretation of Llangorse Textile, by Heather Prosser

Tools and materials

Warp-weighted loom, set up for normal tabby weave.

Fig. 25.3: Embroidered reconstructions.

Loom-weights 150/160 grams. Warp threads were tied to strings attached to the weights, rather than being tied to them directly, which prevented spinning and tangling of the threads

Identical linen or silk thread could not be obtained, so cotton thread was used for the warps and cotton floss for the decorative stitching. These were slightly larger in diameter than the original, altering the scale of the reproduction.

A small weaving comb and bone and metal needles were also used

The Design

When viewing the stitch plan, the most striking feature is the constantly recurring use of pairs of decorative silk threads. This is apparent in both the silk ground and the motif design in both warp and weft, and suggests that silk supplementary warp and weft threads were introduced as stepped pairs rather than as single threads as in embroidery. Additionally, all the individual blocks are made up of even numbers of threads.

The Technique

Before looking at the lion segment in greater detail, the basic ground cover technique on the original needs to be considered. This interpretation suggests that silk supplementary warps were introduced as paired loops onto each odd linen warp at the beginning of each new sequence. The left strand appears to have served all odd main warps and the right, the even ones, accounting for the pronounced stitch slant. It is suggested that odd and even supplementary strands were used on alternate rows and worked from left to right and down over the tabby web to achieve the necessary 3/1–twill effect. Similarly, supplementary weft pairs seem to have been introduced onto odd linen warps and worked left to right and upwards onto the preceding row. The opposing angle of supplementary warp and weft application produces a stunning textural contrast. Where design elements are introduced, supplementary warp and weft threads forming the motifs are introduced in pairs onto odd-numbered linen threads. Although worked on the loom the technique could probably not be described as conventional soumak. Stitches move freely between rows and are worked only from left to right.

Method

The sample was woven in the same direction as the stitch plan. The left- and right-hand sides were worked simultaneously.

Left-hand side: Supplementary weft loops for the ground cover were introduced on every other row to each linen warp intersection, and

worked up and across left to right. The upper strand served the odd rows and the lower the even rows. Supplementary warp loops for the motif were introduced on odd cotton warp threads as required, the left strand serving odd numbers, the right even.

Right-hand side: Supplementary warp loops for the ground cover were introduced on every odd cotton warp thread except where a supplementary weft for the motif was to be placed. The left strand served the odd threads and the right, the even threads on each alternate row (when to front of loom). Similarly supplementary weft loop pairs were placed on odd cotton warp threads where required for the motifs.

Problems encountered

Due to inexperience this first interpretation was very warp-faced. Problems were also due to the inaccurate size of the warp and supplementary threads and the inability to knock-up the weaving satisfactorily, the supplementary threads preventing this. It was found later that this problem could be solved by leaning the loom against a beam so that the back of the work could be accessed. It was also difficult to know whether to finish supplementary strands or to re-work them.

A second reproduction was attempted incorporating all the features aforementioned. Firstly, linen thread, of the same diameter but more loosely spun, and secondly, fine polyester thread were tried in order to produce a replica more accurately to scale. Unfortunately, neither thread proved adequate, the warp threads frequently breaking, and the attempt was abandoned until suitable materials can be obtained.

Time Taken

Each row, including weaving the base textile and working the decorative stitching, took approximately half an hour (Fig. 25.4).

Conclusions

The experimental work has demonstrated that the Llangorse Textile could have been produced either by embroidery or by weaving. A

difficulty in obtaining correct materials has meant that neither sample is an accurate replica.

The embroidered sample appears at first glance to be nearer to the original, since it uses a base textile of almost exactly the same thread count and diameter as the original, but the silk thread is too thick, and the background is stitched in two-ply rather than single-ply thread, giving a different visual effect.

The woven sample is not correctly to scale, owing to difficulties in knocking up the weft, as described, to threads of larger diameter in both the ground textile and supplementary threads, and to the inexperience of the weaver in what is a very complicated technique. However, a second sample, which was abandoned owing to breakage of the unsuitable warp threads, was much closer to the original in scale, and it is felt that with practice, and with correct materials, an accurate replica could be achieved.

Fig. 25.4: Woven reconstruction

Attempts to source correct materials are continuing, as is the drawing of the stitch plan of the textile. It is hoped that, as this stitch-by-stitch scrutiny of the original fabric continues, further clues will be found that will suggest which technique was used to produce this unique textile.

Notes

1 Prosser 2003.

2 Redknap & Lane 1994.

3 Mumford 2002, 471–483.

4 Granger-Taylor & Pritchard, 2001, 93.

5 Mumford 2002, 471.

26 A Study of Textile Remains from the 5th Century BC Discovered in Kalyvia, Attica

by Christophe Moulherat and Youlie Spantidaki

The excavation of a 5th-century cemetery in Kalyvia, Attica, led to the discovery of a number of textile remains. They had been used to cover a dinos vase containing the cremated bones of three people. The cloth is mineralized, which, though helping its conservation, makes the analysis extremely difficult. It is an exceptionally fine weft-face tabby weave and has an open-work appearance. There are fragments of a starting border: a twisted cord of a Z-plied yarn composed of two S-spun threads. The first seven wefts have a violet color identified as purple. Linen has been identified for the warp threads and the analyses of the wefts suggest the presence of silk.

Archaeological Background

During a 1999 rescue excavation of a 5th-century BC cemetery in Kalyvia, Attica, some 20 km south-east of Athens, a marble urn was discovered containing a *dinos* vase. The incinerated remains of a young woman of around 25 years of age, a young man of 35, and a child under 10 years of age were found in the urn.[1] A flower wreath, which rested on top of the bone remains, crumbled into dust when the urn was opened. Covering the lid and the sides of the *dinos* was a textile, of which several fragments have been preserved.

The Textile

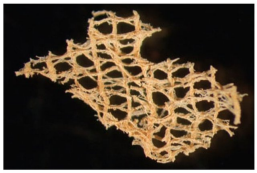
Mineralization is the reason for the exceptional state of preservation

of the textile remains: mineral salts (calcium carbonate) from both the *dinos* and the external environment were deposited on the fibers to create a sort of gangue, which, whilst protecting the fibers, considerably reduces their legibility. Despite this, we were able to carry out a fairly thorough analysis, which highlighted the quality of the work made by textile weavers in Ancient Greece.

There are around twenty textile fragments, which vary from 2 to 8 cm. They are characterized by a large number of superimposed layers. The fragment in Fig. 26.1 has around 40 layers of a total thickness of 2 cm, showing how fine the cloth was. The open-weave appearance means that one can distinguish the threads of more than one layer, and this has created serious problems for their study. We have isolated one layer and have discovered that the cloth is a weft-faced tabby weave (Fig. 26.2) with the following features: the warp threads have about 20 to 25 ends per cm, and they are Z-spun with an average diameter of 0.12 mm. They are stronger and straighter than the weft picks and contrast very significantly with their undulated character. The wefts are mostly without twist or, in some places, with an extremely slight S-spin. There are about 60 to 100 weft picks per cm and an average diameter of 0.05 mm. This difference in the number of wefts gives the cloth a varying appearance. We have, at times, observed the presence of weft floats but the analysis has been made on very small fragments and it is very difficult to assess their effect on the cloth.

Fig. 26.1: Textile fragment from the marble urn.

Fig. 26.2: An isolated layer of the textile fragment.



The Selvedge

In one of the fragments, there are the remains of a starting border visible over almost 2 cm: a twisted cord of a Z-plied yarn composed of two S-spun threads, each one with an average diameter of 0.3 mm (Figs. 26.3 and 26.4). The warp threads pass through each twist of the cord, which is probably made of one tablet with two holes. The first seven wefts have 7 picks per mm and are of a violet color. The existence of a starting border links the textile with the warp-weighted loom described as being the traditional type of loom in Ancient Greece.

The Fibers

The fibers of the warp and of the cord have been identified, by scanning electron microscopy (SEM) analysis, as being made of linen (Fig. 26.5). The bad condition of the wefts has not, until now, allowed for a sure identification. Analysis has eliminated the presence of wool and fibers of vegetable origin (Fig. 26.6). The fact that they are extremely fine, with an average diameter of 0.05 mm, together with the lack of twist suggests the presence of silk, a fiber already identified in textiles contemporary with the Kalyvia cloth found at the Kerameikos cemetery in grave HTR 73.[2] Additional analyses will be carried out to confirm the identification.

The Dyes[3]

The dye-stuff from small fiber fragments (less than 1*10–[4]g) was extracted and analyzed by high performance liquid chromatography with a UV-Vis spectroscopic detector (HPLC-DAD) according to internal laboratory standard LC/ COL-P20/A41.

The analytical result reveals a series of indigoids characteristic of true (so-called ‘Royal’ or ‘Tyrian’) purple: indigotin (Ind),

monobromoindigotin (Br-Ind), dibromoindi-gotin (6,6'diBr-Ind), indirubin (Inr), 6–and 6'-monobromoindirubins (respectively 6Br-Inr and 6'Br-Inr) and dibromoindirubin (6,6'diBr-Inr) (Fig. 26.7). The qualitative 'fingerprint' and semi-quantitative results obtained unfortunately do not allow a precise identification of the mollusc species. The comparison of our results with others, those already published on some Mediterranean snails[4] along with our own references, indicates that we probably have a mix of juices from several species or an altered (partially debrominated) dye,[5] or even both. However, if we consider the case of debromination, the result obtained corresponds more likely to *Murex brandaris* than to *Murex trunculus*. According to Schweppe,[6] the first species was actually commonly employed for dyeing (or more precisely 'staining') in Ancient continental Greece. For these reasons, and given the current state of our knowledge of shellfish purple, only the above hypothesis can be proposed.

Fig. 26.3: Starting border followed by 7 purple-colored wefts.

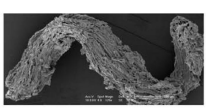


Fig. 26.4 : SEM observation of a starting border cord.

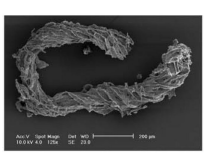


Fig. 26.5 : SEM observation of a warp yarn.

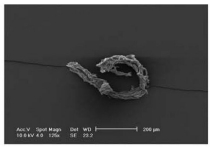


Fig. 26.6 : SEM observation of a weft yarn.

Conclusion

The initial results have brought to light a textile, which by its delicacy and the specific weaving method used, is an exceptional example of textile production in Ancient Greece. The presence of cloth in 5th-century cremations has been seen on a number of occasions in Attica, in particular at Eleusis,[7] Kerameikos[8] and Koropi,[9] where cloth was used in different ways in burial rites. At Kalyvia, the cloth was on the outside of the *dinos*, covering the lid and the sides. The cloth is the fruit of an extremely complex piece of work, which combines a number of parameters: materials of diverse types with threads of different thicknesses, twists and tension. The use of true purple highlights the luxuriousness of the cloth. The cloth is therefore a very rare vestige of the *arachnaia* clothes so often shown on classical statues.

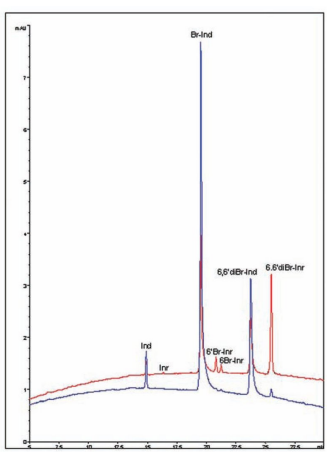


Fig. 26.7: Chromatogram displayed at 548 nm (specific for red

compounds : indirubin and brominated derivatives) and at 608 nm (specific for blue compounds: indigotin and brominated derivatives).

Notes

We would to thank for their collaboration the following individuals: Dina Papathanassiou and Aris Tsaravopoulos, archaeologists, 2nd Ephorate of Prehistoric and Classical Antiquities, Culture Ministry, Greece; Nelly Axioti, director of the Archaeological Museum of Pireus; Tatiana Panagopoulou, conservator of the Archaeological Museum of Pireus.

1 Analysis carried by Dr. Th. Pitsios, Professor of the Medical School of the University of Athens.

2 Hundt 1969, 66–70.

3 Analysis carried out by Witold Nowik, Historical Monuments Research Laboratory, Champs-sur-Marne.

4 Wouters 1991, 17–21.

5 Personal information from C. J. Cooksey (formerly Dept. of Chemistry, University College London).

6 Schweppe 1992, 392.

7 Mylonas 1953.

8 Hundt 1969, 65–71.

9 Beckwith 1954, 114.

27 Ancient Textile Evidence in Soil Structures at the Agora Excavations in Athens, Greece

by Julie Unruh

In the Agora Excavations conservation laboratory, it was observed that some pseudomor phic textile weave structures appeared to extend beyond corrosion layers and continue into the soil on the surface of the objects. This observation suggested that ancient textile information could survive as structural features of archaeological soil. Subsequently, approximately 50 objects dating from the Bronze Age to the Byzantine period were flagged at the Agora as potentially containing textile information within soil structures on their surfaces. The structures appear to be positives, rather than negative imprints, and they are not always associated with pseudomorphic metal corrosion. Mineralization may play a role in their preservation; however, they do not appear to be fully mineralized. Although generally only fragments remain, textiles in this unusual state of preservation can be documented. Four case studies are described: a 5th-century BCE probable paint palette cover, an 11th-century CE burial cloth; textiles within a 5th-century BCE ceremonial deposit; and a textile associated with a Mycenaean pot dated 1400 BCE.

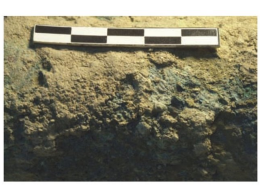
At the Agora Excavations in Athens, Greece, textile 'ps eudomorphs' are excavated regularly.[1] Pseudomorphism is a phenomenon that is not fully understood, but essentially, as the corrosion layer of a metal artifact grows, corrosion molecules migrate into the interstices of any adjacent organic material, creating either a

positive or negative cast of that material.[2] If a textile is adjacent to a metal object in the burial environment, a replica of the textile can be preserved in this way. Many textile pseudomorphs can be analyzed in terms of thread counts, yarn diameters, weave structures, and so forth; and in burial environments where organic textiles do not survive, excellent evidence for ancient textiles has been obtained from textile pseudomorphs.[3]

During documentation of textile pseudomorphs on newly excavated objects in the Agora conservation laboratory, Athens, it was discovered that the textile weave strucures occasionally seemed to extend beyond the corrosion layers and continue into the soil on the surface of the objects. An example of this phenomenon was seen on a 5th-century BCE bronze measuring cup with a pseudomorphic textile wrapping (Fig. 27.1). During cleaning, structures were seen in the surface soil that were very similar to the pseudomorphic textile structures in the corrosion layers (Fig. 27.2). In fact, the structures in the soil would have been considered to be textile evidence had they been formed of corrosion products rather than soil.

Fig. 27.1: Pseudomorphic textile on a 5th-century BCE copper alloy measuring cup.

Fig. 27.2: Textile-like structures within the surface soil on the cup in Fig. 27.1.



This observation, that soil associated with pseudomorphic textiles can have a structure mimicking that of the pseudomorphs, was made repetitively at the Agora. These observations raised the possibility that ancient textile information could be preserved as structures within archaeological soil; and if so, that even soil not associated with pseudomorphs might contain textile evidence. During the 2002 excavation season, a lump of sandy soil was excavated which supported this idea. The soil, from a good 5th-century BCE context, preserves a clear imprint of an ancient textile (Fig. 27.3). The textile is a plain weave, 10 × 10 threads per cm, with Z-twisted yarns 0.35 mm in diameter. The fact that this structure has survived as a feature of the soil for 2500 years indicates that textile information can exist in archaeological soil; and that if retrieved and analyzed, it can contain a useful level of information.

Fig. 27.3: Impression of a 5th-century BCE textile in soil.

Additionally, an informal survey of archaeological conservators yielded anecdotal evidence that the phenomenon had been observed on other sites. It was decided to consider textile-like structures in the soil to be potential textile information, just as textile-like structures in corrosion layers are regarded as potential textile information. As a consequence, over three excavation seasons, approximately 50 artifacts were flagged as possibly containing textile evidence within the soil adhering to their surfaces. Many of the suspected textile/soil structures are not associated with metal pseudomorphs; they are simply soil structures on the surfaces of inorganic objects. Normally the textile/soil structures cannot be removed from the associated objects without destruction, and as with pseudomorphs, many conventional textile

analytical techniques cannot be applied. Generally, only small areas are “readable.” Nonetheless, these structures can be documented just as pseudomorphs can be documented, and could contribute significantly to our understanding of ancient textile production and use.

5th-Century BCE Paint Palette Cover

In 2000, a 5th-century-BCE amphora base sherd was excavated which contained large lumps of red and yellow pigments in its interior. It is believed that it was reused in antiquity as a paint palette. Several amphora sherds reused in this way have been identified at the Agora.[4]

During examination in the conservation lab, the following observations were made:

–There were faint but regular grid patterns in the soil in numerous locations on the surface (Fig. 27.4). Most of the patterns seemed to be three-dimensional reliefs rather than negative impressions.

–The soil hung off the edges in very thin sheets, resembling cloth (Fig. 27.5).

–A small brown ‘twig’ was discovered to have horizontal and vertical elements, and was identified as a tiny fragment of textile.

–At a second location a largely amorphous, brown mass was observed to have right-angled edges which were found to be composed of yarns in alignment. It was also identified as a fragment of textile.

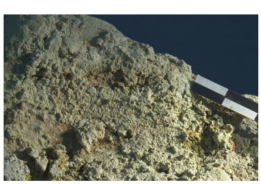


Fig. 27.4 : Grid patterns in the soil on a 5th-century BCE amphora sherd reused as a paint palette.

The discovery in the conservation lab of extant textile in the form

of tiny brown fragments–easily overlooked in the field –prompted a re-evaluation of the soil features observed during the conservation examination. Overall, the grid patterns lined up in the same direction, and the dimensions of the patterns were the same. Furthermore, if the soil structures were analyzed as if they were textile structures, the statistics matched those extrapolated from the extant textile fragments fairly well. It was first believed that the grid patterns overall indicated that textile fragments existed just under the surface of the soil. However, cleaning tests did not reveal further extant textile. The grid patterns evidently are soil structures only.

It seemed reasonable to assume that the soil structures resulted from the former presence of the textile. If so, the soil structures delineate the position of the textile in antiquity: extending across the entire surface of the palette and over the edges. Because the extent and location of the original textile could be extrapolated from the soil evidence, it was possible to hypothesize the original function of the textile: as a cloth cover over the pigments on the paint palette. This is unique evidence for the use of a textile cover on a Classical Greek paint palette. It is evidence that came primarily in the form of soil structures which retained textile information.

The preservation mechanism for these soil/textile structures has not yet been clarified. They appear to be positives rather than negative impressions. They resemble pseudomorphs, and the Fourier Transform Infrared spectroscopy (FTIR) analysis discussed below indicates that mineralization may play a role. However, ‘mineralized’ is a term normally used to designate objects that are encrusted with, infilled with, or chemically complexed with a mineral on a molecular level. These structures do not fit that definition: they appear to be composed of a mix of soil components, on a more macroscopic level. And unlike what are commonly called ‘mineralized’ textiles, the remains are not particularly solid or cohesive.

Fig. 27.5: Sheetlike soil on the edge of the amphora sherd.

One theory is that enough fiber polymer chains remain to retain the structural integrity of the textile in spite of very advanced decomposition. A second theory is that these structures represent a form of incomplete mineralization. The Agora soil contains a fair amount of calcium carbonate, and both FTIR analysis[5] and microchemical tests[6] indicated that the textile/soil structures do contain a carbonate. According to this theory, calcium carbonate mineralization begins in the usual way, but microscopic soil components become embedded in the growing mineral structures. The fibers never become completely mineral-replaced or mineral-encrusted, but the partial mineralization serves to retain the basic morphology of the fibers. This theory fits well with the observed structures, and also may explain how the soil structures are able to survive burial and excavation.

11th-Century CE Infant Burial

If textile information can survive as soil structures, it makes sense to look for those structures in places where we would expect textiles. An 11th-century CE infant burial inside a storage jar was uncovered during the 2002 season. The storage jar was lifted and brought to the conservation lab where an excavator documented and exhumed the burial in a more controlled setting. Because the excavation took place in the conservation lab, there was a frequent exchange of information between the excavator and the conservators, and the collaboration proved beneficial.

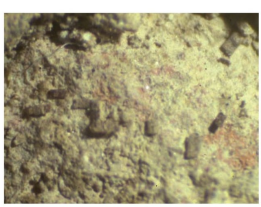
Fig. 27.6: Textile-like structures in soil within an 11 th-century CE infant burial.

It was probable that the buried infant was wrapped in textile, so

it seemed reasonable to look for textile remains in the soil near the skeleton. Fig. 27.6 shows a clump of soil on a base sherd adjacent to the skeleton. This soil has a regular, three-dimensional grid pattern which looks very much like a textile pseudomorph. This soil structure can be analyzed in the same way that a pseudomorph can be analyzed. Thread counts were estimated at 11 × 14 threads per cm, with S-twisted yarns approximately 0.8 mm in diameter; and it was speculated that the weave is a plain weave, though this guess was due to the regularity of the structure rather than to an observed weave.

Microscopic examination of this soil revealed that it contained numerous unusual brown 'segments' not normally present in the Agora soil (Fig. 27.7). They are approximately 0.2 mm (200 microns) wide, regular in length and periodically configured in lines, rows, or right-angled patterns. Magnified × 50, it can be seen that they are not homogeneous, but rather conglomerates composed of ordinary Agora soil components including minute rocks, charcoal fragments, and mica. However, the dark color is due to organic staining, which indicates that these segments contained, or still contain, an organic element.

Fig. 27.7: Unidentified 'segments' in the soil of the infant burial (50x).



Consultation with a geologist, a paleobotan-ist, and an entomologist ruled out possibilities that these conglomerates were common soil features, plant remains, or insect debris. In an effort to identify an organic element, Fourier Transform Infrared spectroscopy was attempted. The FTIR analyses gave spectra matching calcite and silicates, indicating that there is less than 10% organic material present.[7] Consequently, at present, it can only be said that these structures are primarily mineral. Clearly it is imperative to continue to investigate these features, and to try to

identify the organic component by different means.

However, the right-angled orientation of these 'segments' seems unusual. In light of the fact that the soil from which these fibers came mimics the structure of a textile, it was proposed that the segments could be the remains of textile fiber segments, partially mineralized as outlined above. If that is the case, then their regular size is due to the regular structure of a textile weave. They broke at regular intervals because they were stressed at regular intervals.

Identical small segments have been found associated with other suspected textile remains, as discussed below.

5th-Century BCE Pyre Deposit

A deposit of 18 miniature cooking pots was excavated underneath a 5th-century BCE building foundation in 2001. Deposits such as this one are widespread at the Agora and have been interpreted as remains of building rituals.[8]

Good communication between the field excavators and the conservation lab had established the idea that soil structures might contain useful information. In an excellent example of productive cooperation between conservators and archaeologists, pots from this deposit were brought to the conservation lab uncleaned. In the lab, it was found that the soil on the surfaces of many of the ceramic vessels from this deposit mimicked the appearance of textiles. The textile-like features, again, seemed to be positive elements rather than negative impressions, and included:

–Parallel ridges of soil (Fig. 27.8).
–Soil ridges aligned at right angles (Fig. 27.9).
–Regularly spaced bumps of soil in a grid pattern, similar to patterns which are thought to be pseudomorphic textile evidence when seen within corrosion layers.
–Soil that appeared to have a woven structure (ridges going over and under other soil ridges).
–Soil that clung to the surface in thin sheets, with a line of cleavage between the soil and the ceramic.
–Soil with an almost 'furry' appearance. The appearance of the soil suggested the presence of fibers; however, it did not appear to contain root fibers, which are routinely seen in the conservation lab. With binocular microscopic examination,

this soil was found to be composed of normal soil components, not fibers.

–Areas of organics-rich soil as evidenced by a dark brown or yellow-brown color.

–On two of the ceramics, numerous brown unidentified ‘segments’ of between 0.15 and 0.2 mm in width, identical in appearance to those found in the infant burial. As with the burial, they were occasionally aligned in rows or at right angles.

Fig. 27.8 : Ridged soil on a 5th-century BCE ceramic.

The two pots on which the ‘segments’ were found both had soil structures that could be analyzed as if they were textile pseudomorphs. On both pots, the soil/textile structures averaged thread counts of 10 × 13 threads per cm, with yarns averaging 0.6 mm in diameter, possibly Z-twisted, and probably a plain weave. The similarity of the analysis on the two pots suggests that they could be features of the same cloth.

It was never previously considered that textiles might be a component of these pyre deposits. However, the textile/soil structures offer evidence that textiles may have been used in the ceremony, or that these ceramics were buried inside a bag.

Fig. 27.9 : Right-angled soil structures on a 5th-century BCE ceramic.

Mycenaean Alabastron, 1400 BCE

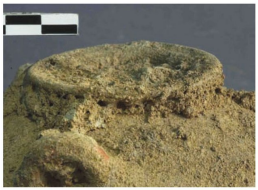
A Mycenaean chamber tomb containing an alabastron dating to approximately 1400 BCE was excavated in 2001. Because the pot was intact, it was brought to the conservation lab unwashed in order to maintain the possibility of analyzing the contents. As a result the excavation soil associated with the pot arrived in the conservation lab along with the pot.

In raking light, it was discovered that the soil covering the mouth of the pot exhibited what appears to be a weave pattern (Fig. 27.10). The weave structure extends across the mouth and continues over the rim. There is enough detail to estimate thread counts, yarn diameters, and twist directions, and again, small mineralized segments are present within the soil.

If we accept the idea that we are seeing the remains of a Bronze Age textile preserved over the rim of this pot, it is possible that further textile details can be seen. Most intriguingly, a series of holes in the textile/soil remains under the rim are fairly regular in diameter and fairly regularly spaced (Fig. 27.11). Because they are perpendicular to the surface of the ceramic, they do not seem to be root holes. If they are interpreted as features of the textile, they suggest drawstring holes.

Fig. 27.10: Soil with a textile weave pattern over the mouth of a Mycenaean alabastron.

Fig. 27.11: A series of holes in the soil under the rim of the alabastron.



An intact alabastron lid has never been excavated. Textile lids for perfume pots have been proposed;9 however, drawstring lids have not. The soil structures on this alabastron may indicate a previously unconsidered lid construction.

Examination of excavated material in the Agora conservation lab suggests that soil features resembling textiles should be given more serious consideration as legitimate indications of ancient textiles. The textile/ soil structures discussed here can be seen with the naked eye; however, raking light at the right angle is often required, making it unlikely that similar structures will be spotted in the field if an effort is not made to look for them. Increased awareness of the possibility of textile evidence in excavation soil and good communication between excavators and conservators will contribute to a greater recovery of these structures, both in the field and in the conservation laboratory.

Notes

1 The term ‘pseudomorph’ designates a once-organic material completely replaced by a mineral salt. Because it is not known if most so-called pseudomorphs are totally replaced, Gillard et al. have suggested the term ‘mineral replaced’ as a more accurate alternative to ‘pseudomorphic.’ However, in this publication the term ‘pseudomorph’ will be used as it is commonly used in conservation practice: to indicate an organic material replicated by metal corrosion products. In this way a useful distinction is maintained between the known phenomenon of ‘pseudomorphic’ textile preservation within corrosion layers on metal artifacts, and the unknown preservation phenomenon discussed here, also possibly a form of mineralization.

2 Chen et al. 1998; Gillard et al. 1994; Jakes & Sibley 1984; Janaway 1985.

3 Sibley 1986, Vollmer 1975.

4 Lawall et al. 2002

5 D. Thickett, 2002, personal communication. FTIR analysis performed at the Department of Conservation, The British Museum, Great Russell St, London, WC1B 3DG.

6 With the addition of dilute hydrochloric acid to a sample, the evolution of carbon dioxide indicates the presence of carbonates: Odegaard, Carroll & Zimmt 2000, 102–103.

7 D. Thickett, 2002, personal communication. FTIR analysis performed at the Department of Conservation, The British Museum, Great Russell St, London, WC1B 3DG.

8 Rotroff 1997, 212–214.

9 Åström 1965.

PART 4 SOCIETY

28 Weaving the Social Fabric

by Elizabeth J. W. Barber

Society uses the fiber arts for social as well as practical purposes, and has done so almost from the beginning. For all the basic processes of cloth-making–fiber production, thread-making , weaving, dyeing–society has put social values and social restrictions on who does what aspects of the work. Social values have also been placed on the disposition of the final cloth: who makes cloth for humble or festive household use, for large estates, for sale, or for gifts? Whose cloth, and what kind, goes to a guest, a servant, a deity, or a political ally? Who may sell what cloth, if any, and is marketing it a right, a duty, a privilege, or a scandal?

Once woven, the cloth may be embellished and/or made into furnishings (for private or public use, and/or for conspicuous display) or clothing, whether daily/practical or festive. Intentionally or not, all these textiles send social messages from the moment they are seen. Thus, for example, the materials, colors and arrangements of a woman's 'folk costume' from eastern Europe may proclaim its wearer's matrial status, religious and political affiliations, approximate age, wealth, occupational status, and domicile (down to the village). To the historian of costume, it may also tell much about the history of beliefs of the wearer's ancestors, back even to the Bronze and Stone Ages.

Society has apparently used the fiber arts–both the products and their manufacture–for social as well as practical purposes almost from the start.

First of all, we have put social distinctions and values on who does what aspects of the work–distinctions, for example, like

gender. When textile tools occur in ancient graves, they are generally women's graves, and when we find clear representations of textile making, they show women doing the work, except in a few special circumstances.[1] Most of the time, it seems, textile work was done by women.

One aspect of textile work, however, in which men often shared the labor, was in fiber production. Thus in Egypt, men typically raised the flax, while in Bronze Age Greek records, the names of the shepherds are typically male –although both men and women, boys and girls, help herd sheep today: for example, in the Balkans and the Eurasian steppes. Shepherds, male or female, also collected the wool, whether by combing it loose, as in the Bronze Age, or by shearing the sheep (an Iron Age method).

Spinning was chiefly women's work–probably right from the start, to judge from Mesopotamian representations from the 4th millennium and later. The European evidence, starting with such sources as the Mycenaean tablets and a Hallstatt vase of the Late Bronze Age, also shows women doing this task. The tradition continues among the Etruscans, Greeks, and Romans, and through medieval Europe to modern times. Girls hoping for good husbands were judged by their skill at such tasks–both in Ancient Greece (as shown by an industrious young girl of perhaps 12 surrounded by suitors on a 5th-century BC vase from Orvieto) and in rural Europe during the last centuries. So important and so time-consuming was this task that women became adept at doing it while they went about their other chores: rocking the cradle, feeding and herding the animals, dictating a letter to one's secretary, traveling–and even (in 1962) tending the bus station.

Despite its being so necessary, however, the work seldom carried status. Homer mentions a poor widow eking out a miserable livelihood by spinning wool for others,[2] while later European women who failed to marry had to earn their keep by spinning for another's household, receiving the demeaning title of 'spinster.'

Ancient Egyptian murals, on the other hand, show a subtler social fabric. Here both sexes spun, each for his or her own needs. Women spun the fine thread for weaving cloth, while men spun the string, cordage, and ropes needed for work in the fields and workshops: for binding sheaves and packages, hauling boats and blocks of stone,

and so on. Children spun, too. We see them with their mothers in the weaving workshops, in a sort of vocational school: the little girls set up on blocks so their spindles can drop an efficiently long distance, and the little boys learning to make the primary thread that, plied together repeatedly, is the basic ingredient for building up heavy twine and rope.

China was different still. Making silk thread by reeling off the cocoons required such fine, soft hands that girls, preferably unmarried, were sought for the work; and they could sometimes even successfully flee unwanted, arranged marriages by working diligently in the lucrative silk-houses.

Weaving, too, was basically women's work –as we see it from China to the Mediterranean and to the Americas. Socially, it was often a communal activity. Any handweaver knows how much more efficient it is to warp a loom with two people than with one. And in many ancient representations, we see two or more women working at a single loom. The European warp-weighted loom seems normally to have been worked by two women at once–or even more. The weft structure of a huge woolen cloak from Bronze Age Trindhøj in Denmark proves that *three* women had been weaving simultaneously, passing their shuttles to their neighbors as they changed the shed.[3] (And the middle lady wasn't as fast as the other two–maybe she was gossiping too much!) To weave on the horizontal ground loom, both Egyptians and Mesopotamians set one woman on each side, to pass the weft bobbin back and forth through the shed, and to help each other change the heddle bar and beat the weft in. Some Egyptian representations show a third woman tending the unused part of the warp, presumably so it wouldn't tangle. One has to guess that much talk went on in these communal workshops. In fact Euripides, in his tragedy *Ion*, has the women comment that they used to tell and listen to myths while they wove. This is not much different from what we see happening still today in women's working-bees in Hungary and other parts of central Europe, where for 3000 years the women who sit together spinning, weaving, and embroidering have entertained each other with stories, songs, and dances–and, for the young ones, courting.

Regardless of gender, the status of a weaver could vary enormously, even within the same culture. In Syria around 1800 BC, queens ran textile workshops powered by captive women,

whereas in Assyria, merchant-class women were in business for themselves, sending the fancy woolen cloth they wove to Anatolia with caravans of tin so their menfolk could sell the cloth and send the women the profits. In Crete, too, women's output of fancy cloth helped pay for the importation of metals and other foreign goods. We can deduce that these women were predominantly free, not slaves, because of the intricacies of their designs, which bespeak artistry over efficiency. In Homeric Greece, queens like Helen and Penelope wove figured cloth themselves, while their captives wove the plain sheets and towels. A Sidonian captive who could weave fancy patterns was viewed as a treasure.

On ancient Egyptian estates, women grouped into workshops typically produced the cloth from start to finish, whereas men wove mats. This was the distribution until Thutmose III imported tapestry technique and the associated two-beam vertical loom from Syria around 1480 BC. Then suddenly we see *men* weaving at these new looms –weaving fancy prestige fabrics for the wealthiest of the nobility (while the women continued to weave the utilitarian sheets and diapers). The same social dynamics occurred among the Ashanti and certain other African groups in more recent times, where only men wove, since cloth was a cash-bringing prestige item, rather than a daily necessity. We see the same in Classical Athens, where 'proper' women stayed at home spinning and weaving with their maidservants, while a few male entrepreneurs ran small slave-powered weaving 'factories' to sell cloth to men with no households. Records indicate that priestesses and upper-class women produced a small number of figured weavings, which were often dedicated at temples, while a very few foreign male weavers produced expensive figural cloth commissioned by the state for the temple.[4] We hear of only one other class of Athenian cloth-makers–prostitutes, who eked out their living by making and selling fancy hair-bands in their spare time (probably using sprang technique).

To make textiles other than plain white, of course, one usually needed to dye the fibers. Simple plant dyes can be collected, then extracted and used in small quantities in a kitchen pot, and we can guess that many women did just that. But already in the Early Minoan Cretan village of Myrtos, about 2300 BC, excavators found the dyeing tubs set up among other textile equipment in a

communal area. And the ancient words for dyers are usually masculine. Dyes are so messy and often so smelly that societies found it economical for men to act as professional dyers–off at the edge of town. Women could bring these dyers what fibers or yarn they wished to have dyed. We have found such establishments in ancient Corinth and Pompeii, as well as up and down the Levantine coast.

Once you have colored thread, you can also start to embroider: that is, to enhance an already-made cloth. Interestingly, our evidence for embroidery is relatively late compared to that of weaving. Weaving began by 7000 BC in the Old World, but people seem not take embroidery seriously until well after 2000 BC. Evidence leads me to suspect that the Syrians were already embroidering by 1700 BC, and our first well-preserved embroidery, though much later, is Syrian. It comes from Tutankhamon's tomb, about 1350 BC, in the form of a Syrian-style dalmatic decorated with panels embroidered with patently Syrian motifs (and also with Tutankhamon's name–so it was made specifically for him, as a royal gift). In many cultures, especially in the Americas, women often made a living enhancing cloth that others had woven, but we seem to have no information regarding this in the ancient Old World.

Laundering the cloth and clothing, once it is made, has also normally been the province of women–with one rather revealing exception. In Egypt, men did the laundry (as both the murals and the literature show us). Why? Laundry there had to be washed in the river, for it never rained, and thus the only water in Egypt was that in the Nile. But the river was full of vicious crocodiles. And since the women had to tend the small children while they worked, it was too dangerous for the future of the race for the women to do the laundry–so in this culture, the men got the job!

* * *

As we see, both men and women, and people of varying ages and social statuses, might do textile work, depending on local circumstances. Let us now turn to the social purposes for which textiles were produced. Their variety is so bewilderingly large that I

have chosen to start the survey chronologically.

Our first examples of the fiber arts, besides the bits of practical string and netting found at Pavlov at 25,000 BC, are the representations of bandeaux, string skirts, and hairnets sculpted on some Paleolithic Venus figures, from about 20,000 BC. Since these garments are clearly of no use for either warmth or modesty, they must be for something else. I suggested long ago that such clothes probably indicated important social information about women–something about childbearing–although precise details for the Paleolithic are hard to pin down. But the tradition of women wearing just such garments continues in Europe, down through the ages to the present day, and is in fact always centered in the marriage customs.[5]

We see Neolithic, Bronze Age, Iron Age, and Classical examples,[6] and on down to the 'folk costumes' or rural dress for women in Eastern Europe today. We know from ethnographic work of the last 150 years that girls were presented at puberty with such a string skirt or deeply fringed apron -- or a woven and often tasseled back-apron that evolved from it, called a *panjova*. Wearing this was an important social badge indicating that the girl now had the miraculous ability to produce new human beings. I own an Albanian apron that was still in use three or four years ago.

The sign that the girl or woman was actually married–that is, no longer available to be courted–was different: her hair was covered completely (as already with the Venus of Willendorf). We learn, in fact, that her hair was thought to be the source of her fertility. Again, we have indicators from Homer and other early sources, of the antiquity of this tradition. The head-cover can be elaborate, often with fringes that have migrated up from the string skirt, or it can be reduced nowadays to a simple but mandatory scarf.

Catholicism wiped out most of this tradition in the West, but it continues, with various modifications, in the East. In fact, over the millennia, these special garments have diverged in form, just enough that the knowledgeable can determine at a glance the village from which the woman comes, as well as data about her martial, religious, and economic status.

What the evidence shows, then, is that the very first clothing was designed not for warmth but for social messages, particularly ones

having to do with marriage and bearing children.

Since women generally make the cloth and clothing, it seems reasonable that women have been prone to encode their hopes and fears onto these objects. In the rural dress of the last two centuries, we see, especially, attempts to use motifs and colors to enhance the woman's fertility, and to protect the wearer (whether male or female) from harmful spirits. East European costumes, for example, are often covered with roses, a protective symbol, seen in Goethe's *Faust* and traceable at least as far back as Homer. But the motif of the crossed and dotted lozenge, known traditionally as the 'sown field'–that is, a plowed field with planted seeds–can be traced back through pagan Slavic fertility designs, all the way to the Neolithic Tripolye culture, where it occurs incised on the bellies and buttocks of Neolithic Venus-type figures.[7] The clincher is that on these figurines the four dots were made by impressing grains of wheat. Truly a 'sown field'–waiting to produce new growth–and a textile motif 6000 years old!

We also read, in European folk tales, of 'magic girdles' and the like. How does one weave magic into a girdle? Perhaps simply through form and decoration, as in the garments we have been looking at; but also maybe by using some sort of 'number magic' in the threads themselves?[8]

The use of garments in ritual contexts is also very old. Our earliest preserved human garment is a needle-netted hat, found at Nahal Hemar in the Judean desert, c. 6500 BC. In that culture, skulls of important ancestors were plastered over to produce a life-like appearance. One of them has a similar net cap modeled onto it.

We can also, of course, use offerings of cloth, clothing, and the like to bribe or remind the deities to do what we want. In eastern Europe, women still place cloths on the trees around springs to get the so-called *vily* or *rusalki* spirits to take away fever and other maladies. And they still tie ritual towels decorated with ancient Neolithic fertility symbols onto the rails around the saints' coffins in

the churches, to remind the potent spirits of favors asked.[9] Back in the Bronze Age, we find faience plaques of dresses in the goddess's temple repositories at Knossos on Crete. The saffron crocuses painted on them can now be explained by a fresco from Thera, on which we see girls picking saffron and offering it to a goddess as part of a puberty ritual. Saffron, which gives a strong yellow dye as well as having a splendid taste, is still viewed in the Aegean as a medicine against menstrual ills;[10] and yellow was viewed as a color worn specifically, and only, by women in Ancient Greece and Rome. In fact, the *peplos,* or dress, that the Athenian women gave to Athena every year as an offering of thanks was saffron-yellow, with sea-purple designs depicting the myth of the Battle of the Gods and Giants (resembling, presumably, the friezed dresses often depicted by Sophilos).[11]

Story-cloths like this, that tell or remind one of myths, rituals, and history, have been important in many non-literate cultures: from the war histories that recently-displaced Hmong women appliqué on cloth in Los Angeles, to the buffalo robes created as year-calendars by the wives of Plains Indian chieftains; from the Bayeux tapestry embroidered by nuns in 1066 to the cloths woven with clan mytho-history that the Ancient Greeks seem to have used at the funerals of family patriarchs.

With or without stories, elaborate cloths often form the backdrops to death and funerals, whether Greek or Indonesian. The Egyptians, too, seem to have tried painting their ritually important funeral scenes onto cloth hangings (as at el-Gebelein), before opting to paint them right onto the tomb walls. And of course, the dead themselves are often wrapped in special cloths, like the Egyptian mummies swathed in 60 yards of linen. This use, too, is early, since another of our earliest textile finds comes from Çatal Hüyük, in Turkey, from 6000 BC, where the excarnated bones of the dead were regularly wrapped in cloth before being buried under the house-floors.

The largest consumers of cloth, however, were surely the living. A well-stocked Egyptian estate stored a vast number of linen sheets, towels, tunics, loin-cloths, and so on: the labor-hours needed to produce them is staggering.

On the other hand, some cultures used cloth and/or textiles not

only for the household, but to make the house itself. Thus the nomadic herders of Eurasia cover their tents, or *yurts,* with huge sheets of felt, and tie everything down with cheerfully decorated woven strips. The designs on these bands signal who owns that tent, thereby having much the same function as flags and banners in medieval times. The floor is cloth as well: densely woven pile carpets that keep out the sand and damp and serve as mattresses for those not august enough to sleep on the one bed.[12] We see a very similar architectural concept among the Marsh Arabs and their predecessors, all the way back to Sumerian times: in this case, splendid houses woven of reeds, with reed floors covered in turn with rugs.

Cloth architecture was known in Ancient Egypt, too. The front of the temple of Luxor has several series of holes placed in arcs–to receive the ends of beams over which one could throw fancy cloth to form canopies, thereby accommodating and shading much larger crowds on certain holidays. It seems that the Egyptians particularly liked to import colorful canopy-covers from the Minoans, as did the Mycenaean Greeks, to judge from the similarities between one Egyptian rendition of such a canopy and the ceiling of the side-chamber at Orchomenos. Certainly the Classical Greeks used fancy cloth canopies and pavilions in front of their temples, as we learn in detail from Euripides. In the Bronze Age, Aegean sailors seem to have used cloth-covered cabins on their boats, an idea taken up with enthusiasm by the Egyptians, which may account for the term 'Keftiu boats.' Among both the Greeks and the Egyptians, having a fancier, more ostentatious canopy than one's neighbor seems to have been a point of honor! As with so many uses of cloth, one's neighbor could see and judge one socially by one's textiles.

Possibly in order to have distinctive cloth whereby to signal such class distinctions, a lively trade in textiles seems to have sprung up around the start of the Bronze Age. There are so many examples of trade that I will mention only one, nearly 4000 years old, yet wonderfully modern. Remember those Assyrian women of 1800 BC who were in business for themselves, sending their output to Anatolia to be sold by their menfolk? We have their letters: they complain that the men keep changing the orders of what to make, they complain that they have to stop and make cloth for special family rituals, they complain about not getting paid promptly. My

favorite is the woman who complains about the price of wool in Assur and asks her husband to send her some cheaper Anatolian wool–but also to hide the silver that represents her profit in the middle of the wool 'so the tax collector won't find it!'[13]

Why does the textile trade seem to begin only in the Bronze Age? Why not the Neolithic? After all, people were already weaving at the very start of the Neolithic.

My own theory, from collecting textile evidence for 30 years, starts from the suggestion that people didn't use textiles often in the Neolithic, and certainly not much for clothing –not until the Bronze Age. Most depictions of humans continue to show most people naked, until after 3000 BC. Clothing was something special you put on for exceptional, usually ritual, occasions–as on the so-called Warka Vase from late 4th-millennium Mesopotamia. The peons bringing in the produce from the fields are naked; only the elite at the top are clothed. That is, just as we saw in the Paleolithic, clothing began for *status*, not for warmth or modesty. Wrap up in the hide from last night's dinner if you're cold!

But note that metals were the first key commodity that people wanted that they couldn't grow or find in their own back yards. To get metals, most communities had to either travel or trade long distances, paying a large price that had to be pooled together by the community. That meant you needed organization, and a few who could organize the many. In short, you began to develop hierarchically different economic classes, some few people being much 'wealthier' than others –wealthier not just in quantity, but in type. And that gave clothing something new to symbolize –not just hopes for fertility and protection, but also messages like 'I've got stuff that you don't!'–stated, in fact rubbed in, continuously. And so we see the robes of kings and queens developing, ostentatiously displaying the most expensive materials and workmanship, all to say, 'I've got stuff that you don't–and more of it, too!'

That, in turn, leads to those people just under the king trying to appear at least *almost* as good–as in the 18th Dynasty Egyptian bedspread from the tomb of Kha. This was done in the newly imported and very expensive tapestry technique, but with the design artfully turned so that the maximum amount of color is put in with a few passes of weft, rather than climbing labor-intensively

up the warp as in the pharaoh's tapestries.

And then the people below *them* try to appear almost as good as *their* superiors. Thus the Greek colonists found that they could have elaborate funeral cloths with clan mytho-history, like the elite families of the mother-cities, by using the much cheaper local technique of *painting* the cloth.

And so on down the line. Breton village costumes imitated the ruffs and stomachers of Renaissance nobility, while Hungarian and Mexican ones imitated with embroidery the banned, but much-desired, printed chintzes that the English imported from India. And school-children in the US pester their mothers for the latest jeans and running shoes endorsed by their favorite athlete. When I was a kid, the labels were *inside* the clothes; now they are outside, so everyone can see who your designer is!

At the very bottom of the textile heap is the lowly rag: cloth that has outlived its original uses, but can still serve *some* purpose, like cleaning shoes. Even these we find in the archaeological record. Among my favorites are: the curved pieces of woven felt trimmed from the corners of the great Danish Bronze and Iron Age cloaks, which turn up reused as foot-wrappers or even pieced together to eke out a crude tunic; and two rags dropped by the Hallstatt miners in the bottoms of the salt mines–one a shred of handsome green and brown zigzag twill, and the other a scrap that found its last use as a wedge to seat the blade of an axe firmly into its handle. This last, which is the earliest datable fabric from these mines, is in polychrome float-weave. If such were the rags the miners used, what must have been the splendor of the finest ancient clothing?

Notes

1 Throughout this paper, see Barber 1991 and 1994 for illustrations and fuller discussion, where not otherwise noted.

2 Homer, *Iliad*, 12.433–5.

3 Broholm & Hald 1935, 242.

4 Barber 1992; 1994, 277.

5 In addition to Barber 1991, see Barber 1999.

6 Along with mention in Homer of Aphrodite's marital 'girdle of hundred tassels,' see *Iliad* 14.153–351.

7 Barber 1999, Fig. 2.3a.

8 I suspect this of the belt from Borum Eshøj, the 24 threads of which are divided rune-like into three sets of eight, but I cannot prove it.

9 Observed in Kiev in 1993. Barber 1997.

10 Marinatos 1984.

11 Barber 1992.

12 In fact, evidence suggests to me that pile carpets were originally invented as nomads' sleeping-rugs, similar to the *tulu*.

13 Veenhof 1972, 113–115.

29 Invisible Exports in Aratta: Enmerkar and the Three Tasks

by Irene Good

Long-distance exchange is a subject of great interest to scholars of the ancient world. Interaction between different groups is a fundamental, developmental factor in early state formation. Although economic texts offer concrete quotidian data, literary texts can shed light on the more social aspects of long-distance exchange. Textiles are a principal medium of exchange, not only because they can be transported as a 'low bulk-high value' commodity, but also because they carry deep social meanings; yet textiles are underrepresented aspects of the archaeological record. The story of Enmerkar and the Lord of Aratta illustrates the importance of textiles as a medium of exchange, and provides a backdrop for archaeological textile research.

In a well-known Sumerian tale, Enmerkar, ruler of Uruk, wished to initiate trade with the land of Aratta to procure precious materials for rebuilding the temple of their patroness deity Inanna, at a time when established trade relations did not exist between the two polities (Fig. 29.1).[1] Uruk therefore sent an emissary to the Land of Aratta to procure the precious stones and metals needed for this important project. The lord of this land first demanded that Enmerkar prove himself worthy of an exchange relationship by successfully performing three *impossible* tasks.

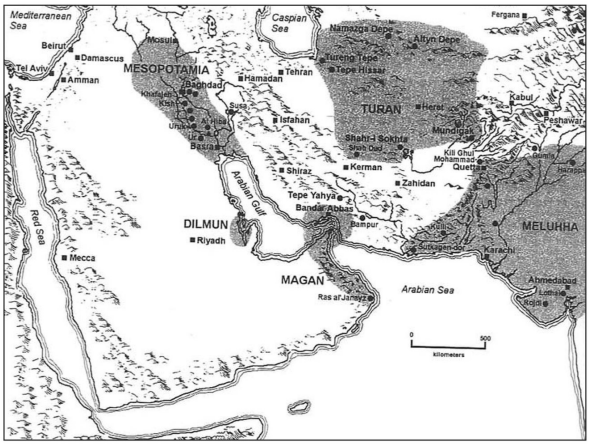
The first task was to bring grain to Aratta, but in a net rather than a sack. Enmerkar sent grain in a net. He cleverly allowed the

grain to sprout first, thereby enabling it be to transported as a cohesive bundle. The second task was to make and bring to Aratta a sceptre made out of an unknown substance–not wood, nor metal, nor stone. Enmerkar made a sceptre out of felt.[2] The third task was to bring this lord a champion fighting dog. The dog was not to be black, white, yellow, red or spotted. Enmerkar brought the Lord of Aratta a champion fighting dog dressed in a little cloth coat.

This story is instructive as a fable; yet it also offers insight for students of social history into the cultural, political and economic dynamics in western Asia in the 3rd millennium BC. There was a dissonance between these two polities, Uruk and Aratta, which was caused at least in part by a critical difference in their respective economic approaches.[3] The Mesopotamian style was a market-based commerce, and the Iranian style was a more prestige-conscious exchange, evidenced by the behavior of the Lord of Aratta. It has been suggested that this discordance may even have been the catalyst for the advent of maritime trade in the second half of the 3rd millennium BC.

The solutions to each of Enmerkar's three impossible tasks in some way relates to textiles and fibers. The first challenge required a specific type of textile: netting, not woven cloth. The second challenge was met by using a felted material. The third challenge was resolved by an unexpected use of woven cloth.[4] This story illustrates, through the medium of textiles, clever challenges and responses in a negotiation of access to precious commodities and of power. The underlying message is clear: not only are textiles a testament to inventiveness and creative thinking, but they also create currency for exchange between polities whose cultural barriers have otherwise hindered economic relations. But what can we see of this in the archaeological record? Where was Aratta?

Fig. 29.1: Map of western Asia showing ancient geographical regions. The area designated 'Turan' is within the area proposed to be ancient Aratta [see Steinkeller 1984, 265 (Fig. 2)].



The Location of Aratta and the Environment of the Hilmand Basin

The description of the landscape along the journey from Uruk to Aratta, taken from no less than four separate accounts,[5] offers us clues about the location and also about the local environment of Aratta. We know from these stories that Aratta was a polity that had direct access to precious stones and metals within its borders, lapis lazuli in particular, and was graced with a city with a royal court. According to the Sumerian texts that mention Aratta, it is a place far away from Uruk. Between Uruk and Aratta were the seven mountains of Anshan, and then an empty plain to cross over once beyond the mountains.

Of the precious stones to be brought from Aratta, lapis lazuli is of central importance, as it is found only in a few distinct deposits in the world. Several scholars have suggested that the location of Aratta would have access to the Badakshan lapis mines of northeastern Afghanistan.[6]

Certainly the access to exchange between Mesopotamia and this area was active during the mid-3rd millennium BC, as evidenced by the movement of chlorite vessels and lapis lazuli[7]–particularly semi-processed stone at Shahr-i Sokhta in Iranian Seistan–and the culturally related sites Shortugai and Mundigak in northern Afghanistan, a region designated *ancient Turan*.[8] The westernmost

of the proto-urban settlement sites of this polity is Shahr-i Sokhta, and is therefore reasonable to be seen as the most likely center of what Sumerian texts refer to as Aratta (Fig. 29.1). Hansmann details the trek from Uruk to Aratta[9] and argues convincingly that Seistan best fits the geographic description, and that Shahr-i Sokhta is the likely candidate for its capital.[10] Much of the alabaster and lapis in processed and semi-processed state has been identified in the craftmen's quarters at Shahr-i Sokhta. The Afghan and Iranian Seistan region as a whole, and the Hilmand Basin in particular, has privileged access from the vantage point of lands to the West to numerous precious mineral and metal ore deposits including silver, from the highlands of the Pamir and Hindu Kush.[11]

The Dasht-i Lut Desert poses a formidable obstacle to travel from Mesopotamia to this region rich in minerals. However, by traversing its southern edge, along southern Anshan and the Makran, one may reach the highlands of Baluchistan, Seistan and Afghanistan. These regions are not only rich in accessible metal ores and other mineral resources, but also provide access to the Indian subcontinent and offer watercourses to sustain life in the foothills along the desert.

The environment of Seistan is essentially a mosaic of dry lowland interspersed with small stands of riparian forest along major watercourses, and halophytic grasslands run along the deltaic fans from the piedmont runoff. This whole region is deprived of marine moisture because of the surrounding highlands and mountain ranges. The environment has not changed significantly over the past 6000 years.[12] However local changes have been dramatic because of the deflection of watercourses, for example in the Rud-i Hilmand.[13] The water table in this region is extremely shallow and rivers are very unstable, changing course frequently.[14] There is, therefore, an abundance of archaeological sites from the Bronze Age through the Islamic period, well preserved due to the dry, salt-rich lithosol alluvial soils, exposed after the rivers have shifted course.

The herbaceous vegetation around Lake Hilmand is typical of desertic and salt steppe, mainly comprised of reed marsh along the periphery of the lake, such as *Juncus maritimus* and *Scirpus mucronatus*.[15] Basketry and reed impressions found in plaster from Shahr-i Sokhta attest the extensive use of reeds in antiquity. Salt crusts developed over the site at Shahr-i Sokhta, acting as a natural desiccant. These unusual edaphic conditions helped to preserve

many organic materials. Textiles were recovered from several different contexts, from all four periods of occupation at Shahr-i Sokhta, spanning over a millennium.[16] Most of the textiles recovered were from Periods II and III, but at least one textile fragment came from Period I. There is also a textile fragment from Period IV.

Shahr-i Sokhta emerged at the beginning of the 3rd millennium BC with signs of long-distance contact from the start, as evidenced by the proto-Elamite tablet found in the deep trench XDV, along with proto-Elamite seal impressions. Connections with southern Turkmenistan are also in evidence from ceramics. Although Period I (3200–2800 BC) is not thoroughly known as yet, it can be stated that the area of the site occupied at that time was about 10–20 ha.

During Period II (2800–2400), there was a shift in settlement to the eastern part of the mound, known as the Eastern Residential Area. The site expanded to about 45 ha by this time. It is during Period II that craftworking was in such great abundance. The activities include semi-precious stoneworking and shell drilling, in particular. By Period III (2400–2000), the site had expanded its original size tenfold, with continuous settlement organization. Graves attest to a certain degree of social stratification, and there is evidence for the accumulation of wealth, particularly among females. Craft working seems to have been directly correlated with the accumulation of wealth. Cultural affinity or contact with other sites at fairly long distances is increasingly evident by ceramics which are related to types from Mundigak and the Quetta Valley. Wheel-made Buff Ware is introduced. Trends initiated during Period II continue during Period III.

Period IV (2000) saw the decline and abandonment of the Eastern Residential Area. The period is known only from the Burned Building, erected in the southern boundary of the Eastern Residential Area towards the end of the previous period. Fire destroyed the structure, and what occurred afterwards was nothing more than squatter occupation. This pattern of abandonment seems to follow a general pattern of de-urbanization at the end of the 3rd millennium BC, as evidenced in other parts of eastern Iran and in Turkmenistan.

An examination of the textiles and small finds from Shahr-i

Sokhta related to textile manufacture has allowed a contextual view of textile production within the economy of 3rd millennium Seistan.[17] Textile production was local and quotidian, evidenced by a wide distribution of spindle whorls and of combs at the site throughout all phases of occupation. Intact textile fragments are all plain woven, some of goat hair and some of sheep's wool, and yet they represent a wide variation in thread spin and gauge, as well as in density of weave, demonstrating a wide variety in usage. Some are fragments of weft-faced slit tapestry; others are of warp-faced strap bands. Many textiles were in the form of cordage and nets of vegetable fiber. Textile and basketry information has also been gleaned from plaster and ceramic impressions. A number of textile fragments evidently were of the same form, yet derived from different loci, thus demonstrating the presence of several cloths of the same cloth type.

Shahr-i Sokhta Vegetable Fiber samples

Vegetable fibers are generally more challenging to identify than animal fibers. Most plants contain fiber cells, usually bundled in the leaf or stem (bast), but sometimes as seed components. Fibers from an animal are self-contained, whereas vegetable fibers are derived from a small part of a plant, and they may or may not be completely processed. Many other plant cells may be present in the sample, such as cork or outer (cambial) cell layers. These extraneous cells may or may not be diagnostic, though their presence informs us of the level of fiber processing. Phytoliths, parenchymal cells and other cellular extranea may assist in identification. Fiber cells are, however, the principal microscopic component to be reliably used in identifying the species of plant from which they derived.

Fig. 29.2: Table showing vegetable fiber fragments from Shahr-i Sokhta. 'Unproc.' = unprocessed, 'Undet.' = undetermined (adopted from Good 1999).

Fiber Sample	Period (phase)	Prov.	Textile Type	Fiber Type
2b	IV	IUB G 112	loose fiber	unproc. *Crotalaria*
3	III	SC	net	*Crotalaria*
4	III	XEU 1	net	*Crotalaria*
5	II (6)	XIR CCXIII	fiber	cf. *Crotalaria*
12	II (6-7)	XIE LVIII	net	*Crotalaria*
21a	II (6-7)	XIE/ XDYLXIX	textile	undet. bast
21b	II (6-7)	XIE/XDY LXIX	textile	undet. bast
22	II	1B 1	twine	*Corchorus*
24b	II	RYL 2	sticks inside	unproc. *Crotalaria*
25	II(6)	XIL 4	net	*Crotalaria*
26	1B 1	LVIII 8	rope	*Crotalaria*
27	II	1B 4	cord	*Crotalaria*
28a	II	1B 4	fiber	cf. *Crotalaria*
29	II (5-6)	XIA	cord	undet. bast
35	II(6)	XIL CCXXX	plied threads	*Linum*
36b	II	1B 4	loose fiber	*Crotalaria*
37	I	G 129	mat	*Scirpus*
58	III	SC	textile	*Linum*
69	II	XIE LVIII 1	rope/cord	*Crotalaria*
70	II	XIE LVIII 1	rope/skein	unproc. *Crotalaria*
72	II	XIE LVIII 4	rope/skein	*Crotalaria*
73	II	RYL E. wall	fibers	*Crotalaria*
74	II	RYL 3	rope/skein	*Crotalaria*
75	II	CCIV	basketry	*Scirpus*

Twenty-four of the more than 100 textile and fiber specimens examined from Shahr-i Sokhta are of vegetable fiber. They are as follows: two samples of flax fiber, as well as 16 of sunn hemp and two of jute (Fig. 29.2). Scirpus reed was also in the vegetable fiber inventory and of the vegetable fiber samples examine only these four types were present. Scirpus reed was used for basketry and matting. It was undoubtedly procured locally, as it is today, for the same purposes.[18] Jute (*Corchorus*) netting from a trash pit in sector XIE was identified. This plant and *Linum usissitatum* may have been grown locally, though it is unclear whether *Linum* was locally produced as a fiber. Flax seed has indeed been identified in modest quantities in the botanical remains from Shahr-i Sokhta,[19] at Pirak in neighboring Baluchistan,[20] at Tepe Hissar on the Damghan Plain,[21] and at late 3rd-millennium BC Shortugai.[22] The linen fibers from Shahr-i Sokhta were scutched down to fiber ultimate (Fig. 29.3), and were from highly spun, two-plied threads, qualitatively unique in the Shahr-i Sokhta textile inventory.

A bast fiber of great interest, known as sunn hemp, has been identified in the form of net fragments in 16 out of the 24 vegetable fiber samples from the Shahr-i Sokhta textile inventory. This tropical plant, *Crotalaria juncea* L., is a fiber native to South Asia. This fiber must have been imported to Shahr-i Sokhta, as

palaeoenvironmental and botanical studies of Seistan do not support the idea that it could have been grown locally. The sunn hemp samples were derived from several types of remains: five were loose fiber samples, five were of rope or skein fragments, and four were from netting. These samples therefore represent different modes of workmanship. The fiber is found only in the unprocessed or semi-processed state (i.e., extraneous cells are present and fiber bundles are intact) as rope or skein fragments, and in a more thoroughly processed state, it is found as netting (Figs. 29.4, 29.5, 29.6).

Local reeds (*Scirpus* sp.) were useful for basketry and matting. They were not, however, adequate for making nets, not having the required flexibility or tensile strength. Flax was present, but not apparently used for making nets; and in fact *linum* was underrepresented in the vegetable fiber inventory. These facts lead us to suspect that the bast from the sunn hemp plant was an important fiber at Shahr-i Sokhta, having multiple uses, both as semi-processed cordage for packing material and as more highly processed nets. It may have even come into the site as nets and cordage to begin with, carrying commodities. The nets made of these fibers may have originated as containers for some other export, possibly from Makran or from Sind.[23]

Enmerkar's Net

Long-distance exchange is a critical aspect of the social history of textiles. The fiber evidence from Shahr-i Sokhta just reviewed brings us a new relevance to the tale of Enmerkar and the Lord of Aratta, specifically regarding his first impossible task. The so-called 'invisible exports'[24] known from Mesopotamian texts (slaves, textiles and foodstuffs), have traditionally been notoriously difficult to detect in the archaeological record. Nets and cordage, though humble and often underappreciated, are crucial components of this movement of goods, in local exchange as well as far across borders.[25] We can now attend to trace evidence of perishable artifactual remains such as these as they are potential indices of imported commodities which are archaeologically difficult to recognize. Far from the land of Enmerkar, the presence of sunn hemp nets and cordage at Shahr-i Sokhta allows us to appreciate the significance of the archaeological recovery of textile fibers. Even

more directly than texts, archaeological fiber evidence can reveal some of the 'invisible exports' that moved across western Asia during the 3rd millennium BC.

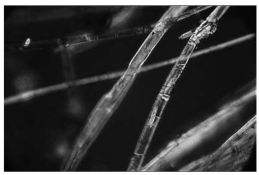


Fig. 29.3: Photomicrograph in polarized light of Linum usissitattum from Shahr-i Sokhta fiber sample #35, from Period II, XIL 4.

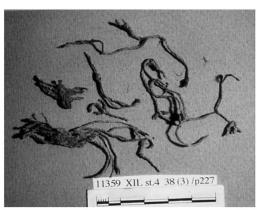


Fig. 29.4: Net fragments of sunn hemp fiber from Shahr-i Sokhta, Period III, XEU 1.

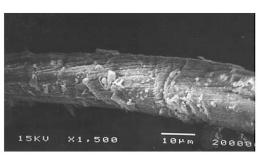


Fig. 29.5: SEM of net fragment sample fiber ultimate, identified as Crotalaria juncea

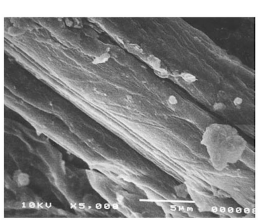


Fig. 29.6: SEM of modern comparative specimen of Crotalaria juncea bast fiber bundle, showing 'S' helical twisting of ultimates.

Notes

1 For full translation from the Sumerian, see Cohen 1973. This and related myths date to the Ur III period (between 2112–2004 BC), though they refer to the reign of Enmerkar, who according to the Sumerian King List reigned ca. 2950 BC: see Jakobsen 1973, table II. Vanstiphout points out that Enmerkar belonged to the second dynasty after the flood, and was responsible for re-building the city of *Unug* (Uruk). Thus the Sumerians set this story in the 'beginning times': see Vanstiphout 2003, 1, 4, ns. 11, 12.

2 The translation is of a felted fibrous substance–'the remnants of cooked hides', Vanstiphout 1991, 225. According to a more detailed interpretation of the text, he describes this material as shining, cured over ten years inside a hollow reed(!); perhaps as a sort of refined fiber-gelatin material. The important feature in the context of the story is that it is man-made, not natural, see Vanstiphout 2003, 81. Steinkeller notes that the reference is obscure, personal communication, 2002.

3 Possehl 1986.

4 Furthermore, the order of these three elements (netting, animal fiber/felt and cloth), follow the order of their invention: first, cordage and netting is made from vegetable fibers, then animal fibers are utilized, then finally loom-woven textiles are produced.

5 As outlined in the tale of 'Enmerkar and the Lord of Aratta', 'Enmerkar and Enushkeshdana', 'Lugulbanda and Enmerkar', and finally 'Lugulbanda and Mount Hurum', see Vanstiphout 2003.

6 Tosi 1970; 1974; Hansman 1978; Pinnock 1988.

7 Lamberg-Karlovsky 1988; Lamberg-Karlovsky & Tosi 1989; Tosi 1970; 1974.

8 Amiet & Tosi 1983; see also Good 2004.

9 Hansman 1972; 1978; see also Steinkeller 1982, Fig. 2.

10 See Madjizade 1986 for an alternate view.

11 Pigott & Stech 1986.

12 De Marco & Dinelli 1977; Costantini & Tosi 1978.

13 Raikes 1983.

14 Fischer 1973.

15 Zohary 1973, 471; Costantini 1983; Costantini & Tosi 1978, 179.

16 Good 1999. The dates are: Period I (3200–2800 BC); Period II (2800–2400 BC); Period III (2400–2000 BC); Period IV (2000 BC).

17 Ibid.

18 Costantini & Tosi 1978, 179.

19 Costantini 1977, 169–170.

20 Costantini 1979, 331.

21 Costantini & Dyson 1990, 57–58.

22 Wilcox 1991, 149.

23 Makran was the place of origin for the abundant Indian chank shells (*Xancus pyrum*), found worked in the Craftman's Quarters at Shahr-i Sokhta, and may indeed have been contained in sunn hemp nets.

24 See Crawford 1975.

25 Indeed, Pinnock notes that at Ebla, a small cache of lapis lazui chunks were found bundled together, apparently in a container (a cloth sack? a net?!) that had completely disintegrated, Pinock 1988, 108.

30 Textile Production at Pseira: the Knotted Net

by Philip P. Betancourt

Pseira, a Minoan town in eastern Crete, had an active weaving tradition. Among the discoveries from the site are representations of knotted nets, which occur on bull figurines as well as on a fresco depicting elaborately costumed women. The tradition of adapting and embellishing the simple net to create an elaborate and highly ornamental fabric seems to have been an important Minoan custom, and many of the more elegant knotted nets appear to have had religious associations for the Minoans.

Pseira is a Minoan town on an island off the northeast coast of Crete.[1] It was first inhabited at the end of the Neolithic period when a small community was established next to a fine harbor on the southeast side of the tiny islet. By the middle of the 2nd millennium BC, in LM IB, the town consisted of over 60 buildings arranged around a large open square. Its residents lived in two-story houses with walls of stone and mudbrick. During the Late Minoan I period, they used pottery decorated in lustrous, iron-rich slip. The pottery from the site provides a good indication of Minoan artistic excellence. Among the designs are several motifs that are borrowed from Minoan religion, including double axes,[2] elaborate floral festoons,[3] and facing bulls' heads.[4] Apparently the items used in religious ceremonies, like the bull that was sacrificed, the axe used for killing it, and the floral garlands used for decoration, were brought into the Minoan system of ornament as symbolic motifs. The Minoans raised sheep and goats, tended olives and other crops,

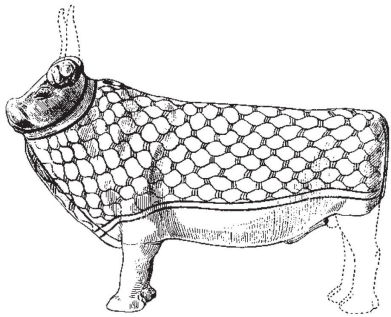
and engaged in seafaring and trade. They were also expert weavers, as is shown by the elaborate costumes seen in wall paintings (Fig. 30.1).

Minoan loom-weights were discovered in many households in the Pseiran town. They indicated that production was performed in several houses in the community rather than in one centralized location. Especially interesting evidence came from the Plateia Building, at the north of the town square.[5] This building, which was one of the largest structures in the town, was constructed in Late Minoan I and destroyed at the end of the period, in Late Minoan IB. It was a large house with evidence for several crafts in addition to weaving, including stone-vase making and the manufacture of objects from triton shells. Clay loom-weights from here suggest that the artifacts may not have been used in matched sets, because the examples from the building were of different sizes and weights.[6]

The loom-weights show that the people of Pseira used the warp-weighted loom, which was usual for Minoan weaving.[7] Loom-weights from Pseira were made of fine to medium-coarse clay. They were discoid in shape. Some of the weights were circular, while others were oval. They could have either one or two holes. Many of the weights with two holes had a groove at the top, and they were probably used with a stick tied on the upper edge, so that the warp threads could be attached to the stick.[8]

Fig. 30.1: Reconstruction of fresco from Minoan Pseira.

Fig. 30.2: Figurine of a bull wearing a knotted net.



Warp-weighted looms had a long history in the Aegean, as well as in later Europe.[9] They were still in use several centuries after the close of the Bronze Age, and they were occasionally depicted on Archaic and Classical Greek vases. A well-known Athenian example by the Amasis Painter shows how the loom worked, with the vertical warp tied to a series of weights to keep the threads taut.[10] The weft could either be woven through the warp threads by hand, picking it through selected threads, or the process could be mechanized by tying selected warp threads to a rod that could be pulled away from the loom to make a shed through which the weft could be passed. By using this type of loom, the Minoans could create a wide variety of both simple and complex woven designs.

Textile patterns on Pseiran clothing, like the example in Fig. 30.1, testify to the intricate fabrics that were possible with a warp-weighted loom.[11]

In addition to woven goods used as clothing, the Minoans also had a tradition of net-like fabrics that could be used as wall hangings and in rituals. This fabric, called the knotted net, has a long earlier history, as it was already being used in the Mesolithic[12] and Neolithic.[13] It has received less attention than the more traditional fabrics of Bronze Age Crete, but the evidence from Pseira and elsewhere indicates that it was a complex and elaborate Minoan tradition. The knotted net is illustrated in several media in Minoan art, especially in contexts that involve religious rituals. Many of the nets are shown in two-dimensional art, but examples of knotted nets on several bull-shaped figurines from Pseira are draped across the backs of the animals.[14] These figurines show that the artist has depicted a flexible fabric that hangs easily over a three-dimensional form (Fig. 30.2).

The net consists of widely spaced horizontal cords tied together at intervals, with the knots alternating from row to row. The weight of the fabric pulls the net taut. An illustration on one of the two gold cups found at Vapheio shows a more lifelike representation of how such a net would be constructed.[15] In this case, the net is a heavy affair made of rope, designed to be strong enough to capture and hold a bull. The knots that hold its strands together are clearly shown.

A similar fabric design occurs on a garment worn by a female figure from Pseira (Fig. 30.1). She is depicted in a painting from a building that may have been used as the town shrine, and her date is Late Minoan I, perhaps late in the period.[16] The intent may be to depict a multi-layered fabric. The continuous nature of the blue and black designs raises the possibility that the garment consists of a background cloth to which other fabric elements have been added. One addition over the garment is a knotted net, with strands of white dots (either a decorated cord or perhaps strands of beads) held together by knots covered by small rosettes. The garment is extremely elaborate. The identification of the figure is unknown, but the fine clothing suggests a woman of elite status, or more likely a goddess. Garments with nets over the fabric like the example from Pseira are also known from the town of Akrotiri, on

the island of Thera.[17]

Examples of the knotted net occur elsewhere as well. One of the most elegant pieces is a wall decoration from the building called Xeste 3 in Thera (Fig. 30.3).[18] In this variation of the knotted net, the horizontal members are composed of multiple strands, some white and some black, while the small yellow ties that hold them together are depicted in a three-dimensional fashion that makes the detail easy to comprehend. The intent may be to depict a net that was hung or sewn over a white background fabric, because blue and yellow rosettes are within the net design as if they were attached or embroidered onto the white background. In the original fabric version, the effect would have been very three-dimensional.

A more schematic painting is in the House of the Ladies on Thera (Fig. 30.4).[19] Consisting of a net pattern on the wall above the female figures, the design includes diagonal lines of red dots with blue diamond-shapes where the dot-bands cross. The ornament is not very naturalistic, but it may have been inspired by a wall hanging.

Additional examples exist in several media. One variation is on a fragment of a fresco found in a house at Kato Zakros.[20] On this example, rosettes cover the knots that hold the strands together, and floral motifs hang within the voids formed by the net. Like the painting from Thera, it may represent a wall hanging. Clothing from Thera also uses the design.[21]A gold seal found in a tomb at Pylos shows the design in miniature.[22]

The knotted net seems to be associated with Minoan religious ritual. The Pseiran bulls[23] have several details that suggest sacrificial symbolism, including their white color, the use of the nets, and the fact that the horns are carefully decorated with floral garlands. These aspects provide clear indications that the animals have a symbolic function, and they do not represent simple work animals or parts of a secular genre scene with cattle being butchered for meat. The clay figure may stand for the real animal to be used in sacrifice.

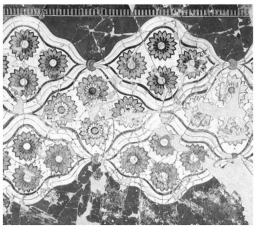


Fig. 30.3: Fresco from Akrotiri, Thera, depicting a wall hanging.

Fig. 30.4: Fresco from the 'House of the Ladies' at Akrotiri, Thera.

Religious associations for the knotted net persist into the Classical period.[24] One of the best descriptions of the use of a net to cover the victim for a sacrifice, although it is written in symbolic and poetic terms, can be found in the Greek tragedy *Agamemnon* by Aeschylus, from the 5th century BC. Great writer that he is, Aeschylus prepares his audience by repeatedly referring to Cassandra and Agamemnon as sacrifices as they approach the place where they will die. In the translation by Herbert Smyth that uses Archaic English,[25] Cassandra, who as a priestess can foretell her own future, cries out to the play's Chorus:

In place of my father's altar, a block awaits me,

butchered by the hot stroke of bloody sacrifice.

(*Agamemnon* 1275)

The chorus replies, again with reference to sacrifice:

But if, in very truth, thou hast knowledge of thine
own death, how canst thou step with calm courage to
the altar like an ox destined of God to the sacrifice?
(*Agamemnon* 1295)

Finally, when Agamemnon has been killed by his unfaithful wife Clytemnestra, she describes her deed:

Deny it I will not. Round him, like as to catch a haul
of fish, I cast a net impassable.… Twice I smote him,
and with two groans his limbs relaxed. Once he had
fallen, I dealt him yet a third stroke to grace my
prayer to the infernal Zeus, the saviour of the dead.'

(*Agamemnon* 1385)

If the Athenian audience knew about the ancient practice of covering a sacrificial animal with a net before it was slain, the reference to the killing of Agamemnon as a sacrifice would make a fitting counterpoint as revenge for the king's earlier sacrifice of his daughter to secure favorable winds on the voyage to Troy.

Minoan fabrics were time-consuming to make, but they were elegant in design. The knotted net demonstrates that in addition to secular designs for costumes, rugs, and wall hangings, fabrics could also be given symbolic meaning. Like double axes, altars, and other tangible objects used in Minoan ceremonies, fabrics could make symbolic references. As such, they were appropriate for repetition as visual reminders of the beliefs that helped bind the Minoan culture together. In addition to their important roles in ritual practices, their repetition as artistic motifs could continue to celebrate the deeper meanings attached to the objects that played

roles in Minoan ceremonies.

Notes

1 Seager 1910; Betancourt & Davaras (eds.) 1995–2003.

2 Betancourt & Banou 1999, Nos. BQ 2, BQ 5.

3 Betancourt & Banou 1999, No. BQ 1.

4 Banou 1995, No. AB 10.

5 Floyd 1998.

6 Betancourt 1998.

7 Barber 1991, Chap. 15.

8 For the survival of the practice into historical times, see Carroll 1983.

9 Roth 1913; Crowfoot 1936–37; Geijer 1979; Wild 1988; Hoffmann 1964; Barber 1991; 1994, 101–126; Davis 1984; Burke 1997.

10 von Bothmer 1985, 185–187.

11 Shaw 1998.

12 Clark 1952, 227.

13 Cardon 1998, 17, Figs. 10a, 10b.

14 Seager 1910, Fig. 7; Betancourt 2001, Pl. 35, No. PS 3643.

15 Marinatos 1976, Fig. 203.

16 Shaw 1998.

17 Doumas 1992, Figs. 100–101, 103, 118, 120–121.

18 Doumas 1992, Figs. 136–137.

19 Doumas 1992, 38–39, Figs. 6–8.

20 Platon 2002, Pl. 48b.

21 See note 17.

22 Buchholz & Karageorghis 1973, No. 1347.

23 Seager 1910, 22–23.

24 For example, a knotted fabric covers the omphalos at Delphi, Courby 1927, 70; Gullberg & Åström 1970, 44.

25 Smyth 1953.

31 Weaving at Akrotiri, Thera: Defining Cloth-Making Activities as Social Process in a Late Bronze Age Aegean Town

by Iris Tzachili

The aim of this paper is to examine the existing evidence for the weaving activities at Akrotiri, Thera, Greece, in relation to the economic and social life of the community: in other words, to correlate the different activities forming part of the production of cloth with the structure of the whole production of the town. Firstly one has to localize the archaeological remains which, although scanty, do exist. Then one has to search for traces of differentiation of the archaeological evidence which may reflect specialization. The next step is to evaluate the evidence from the final products, the cloth and garments which are often depicted in the wall paintings. In relation to this point, after the evaluation of the archaeological evidence, one has to turn to the social relations and the structure of the exchanges inside the town. The cloth-making production is part of them. But as we know from other sources, in some cases textiles have a special role as privileged means of exchange. They are products easily transferred with a long life cycle and with possible use as prestige goods. In this paper I shall try to determine whether these features are also archaeologically visible and valid on Thera. A hypothesis is advanced about the weavers. It is not impossible that weaving production operated inside a kind of women's guild: that is, an articulated group with objectives and an internal way of functioning in which the duties and the profits were distributed according to the skills and the age of the participants.

The object of this paper is to set cloth-making activities in the context of the Late Bronze Age towns of the Aegean and compare them with those of the Minoan towns in the Old and New Palaces of Crete.1 In the commercial island towns such as Akrotiri on Thera, the manufacture of textiles went beyond meeting basic needs–that is, beyond the internal household production and consumption characteristics of small, self-sufficient communities. Nevertheless, weaving production here cannot be equated with that of the Minoan craft-industrial centers, which were subjected to close bureaucratic control. The weaving output of a large state covered a wide geographic area and presupposed distribution of raw materials, constant inspection, record keeping, extensive storage, and careful gathering of end products. The archaeological record provides a picture of great decentralization and detailed archiving. In the island towns, in contrast, the evidence relating to weaving is much more densely concentrated in space, but nevertheless, reveals clear signs of specialization.

To illustrate the above, I shall refer to a particularly well-preserved Cycladic settlement, Akrotiri on Thera. Many kinds of evidence are available: material remains of looms and loom implements, inscriptions relating to the distribution of the textiles, and many artistic representations of the end product. The fabrics themselves are an important subject in wall paintings, where they are shown in the form either of garments worn by persons or as cult offerings.

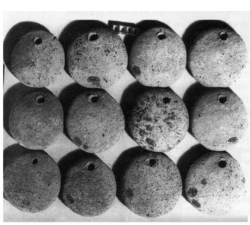


Fig. 31.1: Discoid loomweights from the West House, Akrotiri.

Despite the exceptionally favorable circumstances of preservation

at Akrotiri, no textile fragments have survived.[2] Only a very few, barely distinguishable imprints of coarse cloth on straw mats, or often, whole baskets, have been preserved.[3] The only objects connected with weaving that have been preserved are strings and in one case, ribbons.[4] The deficiency in this sphere, however, is balanced by the large quantity of evidence available for weaving implements.

The preserved evidence here is mainly for upright warp-weighted looms. Many of these weights have survived. The drawers in the storerooms at Akrotiri are full of discoid loom-weights of remarkable uniformity (Figs. 31.1–31.2). This is a well-known Minoan type.[5] Identical loom-weights with very little variation in their dimensions, form or weight were found by the hundreds on the ground floors, fallen from the upper stories.[6] There are slight differences in the way in which the weights were attached to the warp. So far, there is nothing surprising here. Loom-weights of similar form are to be found in many houses in Minoan Crete, at Knossos, Malia, and Palaikastro, on many of the Aegean islands, and in mainland Greece.[7] The situation begins to differ and become interesting when we see that the presence of looms at Akrotiri is sporadic. Although they have a pronounced presence in some areas, looms are not found in all the houses. About 35 houses have been located so far in the excavated area of Akrotiri. Of these, 11 have been partially or completely excavated. Amongst these eleven, loom-weights have been found in only four (Sector A, Room 3 on the upper story of the West House, the north building ensemble in complex Δ, and in almost the whole of Complex B).[8] In contrast, no traces of looms have been found in fully excavated houses like Xeste III and the House of the Ladies. The houses at Akrotiri were autonomous units. Their purpose was, of course, to provide residential space for the Akrotirians, but they were also places of work for other than simple domestic tasks. Most portable goods were processed and stored in multi-purpose rooms that were used sometimes as workshops and sometimes as storerooms–independently of the number of individuals living in each house, the relationships between them, and their social status. The houses of Akrotiri functioned as economically self-sufficient units–like the classical *oikos*–in which the livelihood of their residents was secured. The differentiation with regard to weaving output is therefore very interesting. This is a feature that conflicts with the

model of domestic production and consumption familiar from Classical Greece and Homer.[9] We have grown accustomed to the fact that the art of weaving was exclusively the work of women – all women. It was their task to weave the textiles needed by the family. In the present case, the archaeological picture belies this model.

Two hypotheses can be advanced to account for this situation. According to one, the circumstance that looms are to be found in some houses and not in others is a sign of specialization. Production took place only in some houses, which were tantamount to workshops. And just as there were specialized rooms, there must also have been individuals who specialized in this production, to which they devoted the larger part of their time. The community of Akrotiri was able to relieve these individuals of other duties and allow them to devote a large part or the whole of their time to weaving. The selective presence of looms in some houses is therefore strong evidence that the production of textiles took place selectively in particular house units. This division of labor of course implied greater productivity, and also mutual dependence. It may be recalled that some criteria for urbanization include the specialization and the social cohesion that permits–and dictates–internal exchanges. A high degree of interdependence can be observed at Akrotiri in various aspects of material life.

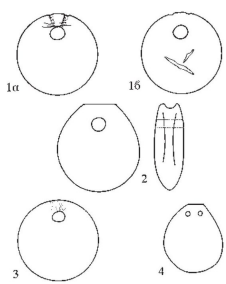


Fig. 31.2: Main types of loom-weights from the West House.

The second hypothesis is that originally there were looms even in the houses where no loom-weights have been found. In this case, the looms simply were of a different type. Perhaps vertical two-beam looms were used, as known in New Kingdom Egypt.[10] These

looms are not as readily preserved as the others, and though their beams may leave an imprint in volcanic ashes, it is difficult to restore them. They may perhaps be identified from some trace in the roof to which the top beam was attached, but since the vertical looms would also have been placed on the upper story, it would be difficult to reconstruct this archaeological picture. This hypothesis partly preserves the well-known model of domestic weaving production and consumption. Only partly, though, for the two types of loom have different properties, different advantages and disadvantages which make them suitable for weaving different kinds of cloth. The vertical warp-weighted loom is a heavy and perhaps tiring device, but it makes it easier to weave multi-colored fabrics, whereas the vertical two-beam type is quicker and better for monochrome cloths. It is also easier and less tiring to operate since the weaver is seated. Specialization, therefore, also applies in this second case. In the first case, specialization would imply the selective distribution of weaving throughout the settlement, while in the second case, it would relate to the kinds of textiles produced. The possibility of the second case is confirmed also by the iconography, in which different kinds of fabrics are depicted.[11]

It should perhaps be emphasized at this point that Akrotiri was not the only settlement on Thera, although very little evidence survives for inhabitation of the countryside. From what little is preserved, it emerges that no traces of looms or loom-weights have been found in the other settlements. This could indicate that weaving was largely confined to the largest town, which would imply significant division of productive activities between the town and the countryside.[12]

The manufacture of thread is the second work cycle that leaves archaeological traces. This is mainly true of spinning, of course, in which spindles and spindle-whorls were used for both wool and flax. It is at this point that we encounter the second characteristic absence at Akrotiri. There are almost no spindle-whorls in these exceptionally well preserved houses. The very few that exist are from earlier levels. This is one of the distinctive features of cloth-making at Akrotiri as well as in Minoan Crete. Again, therefore, two hypotheses may be advanced. Either there was some other method of making yarn, possibly with a different technique that leaves no archaeologically detectable traces, or spinning was done somewhere

else and the threads were brought ready spun to the town. In this case, there would have been a network supplying the weaving workshops with thread, either from smaller islands or from other villages. Here again, the absence points to either strong productive and economic interdependence or a different technique, or, as I believe, to both. It should not be forgotten that spinning is very time-consuming work, requiring many more hours than weaving, and that the large quantities of thread required by weaving also needed additional labor.[13]

All weaving depends on access to raw materials. Just how important this was can be appreciated from the Mycenaean evidence three centuries later, which reveals the enormous efforts made by the Mycenaean authorities to secure a smooth supply of wool to the workshops.[14] If we assume that there was significant production of textiles at Akrotiri, we should also assume there were possibilities of acquiring raw materials locally. Imports may also probably be added, but the core of the production must have been carried out locally. Wool was undoubtedly produced on Thera, as is evident from archaeo-zoological studies, and there was considerable production of flax.[15] Two issues should be stressed at this point. One is that the island was much larger before the volcanic eruption. The potential for raising animals and growing industrial crops, such as flax, was many times greater than now appears from the map. Second, and more important, is the fact that the geographical relief of the island was very different. There is considerable evidence indicating that there were large tracts of fresh water, particularly marshes, which are needed for processing flax.[16] It can therefore be considered fairly certain that there was the potential for local production of wool and flax, independently of any trade.

The archaeological evidence thus points fairly clearly to a specialized production. The question is to what extent was a surplus produced — a *sine qua non* condition for any form of exchange. Generally speaking, specialized production implies that some members of the community offer specialist services on a full-or part-time basis, for which they are provided with their basic needs by other members of the community. This occurred to a great extent within the community at Akrotiri, where there are indications of exchanges at every turn. What is of interest here, however, is whether a surplus was produced with the objective of long-distance

exchanges and trade. Did something of this kind happen? Is there any evidence for the production of textiles destined from the very beginning for export?

Evidence of this nature has emerged during the last decade from the Linear A tablets in Room Δ18 (Fig. 31.3). These are the first tablets found at Akrotiri, though other Linear A inscriptions have been discovered before. One of the tablets records the ideogram for textile with a number next to it indicating a large quantity, more than 200 pieces–the largest quantity of textiles so far recorded in the Linear A archives. This is therefore the record of a huge transaction. Just before the destruction of Akrotiri, more than 200 pieces of cloth were counted and recorded.[17] Consequently, it may be considered as a record of the existence of a surplus, since we are certainly dealing with goods involved in commercial exchanges. Otherwise why would more than 200 pieces of cloth be counted or recorded? The very large quantities of presumably the same type of cloth, since no differentiation is noted, point by themselves to a surplus. The details are lacking that would allow us to set such a record in its historical and social context: the people who undertook the action, the time, the mutual benefits, the way that this transaction was carried out and the social relations that stem from them. We are certainly dealing with long-distance trade, with transactions outside the town. Do the tablets relate to a plan of anticipated production, are they a forecast, stating what is expected as a production target? Is this, in other words, an order? Or is it a receipt of delivery? Were the tablets kept as a delivery receipt or were they kept as the proof of an order? As we have already seen, the interpretative context is missing. But at least we have the record of a presumed long-distance transaction and the fact that this record was kept.

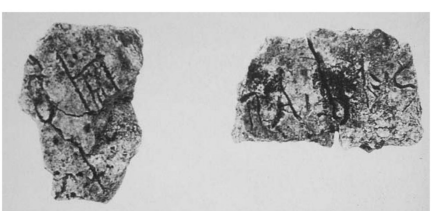


Fig. 31.3: Linear A Tablet from room Δ 18 at Akrotiri.

Let us proceed to the end of the chain, to the end products. I shall not dwell on these – everyone is familiar with the wonderful garments worn by men and women at Akrotiri on various occasions, mainly festivals. It is useful to note merely that weaving products were not only the fine clothes we see in the wall paintings, but certainly included other everyday textiles and in very large numbers probably – rugs, bed and chair covers, curtains, cloth bags, and ship's sails. It may also be worth noting that the brilliant picture of sophisticated urban life that emerges from the wall paintings is due mainly to the elaborate dresses worn by men and women.

Let us now turn to a difficult question. Is there any evidence for the overall social organization of the settlement, the social structure? What were the social relations? Were there any elite groups? And what was the place of cloth production within the whole productive system?

First let me indulge in a parenthesis. Weaving in itself is not regarded as a crucial technology; it is not one of the factors, such as horses, ships, or metallurgy, that determine the fate of social formations. It is not a cutting-edge, a strategic technology. Consequently, the supervision of weaving output may not be a very crucial matter for the community.[18] It is, however, an activity which, with the added value invested in it and the relatively long utilization of its products, produces wealth when traded or gives prestige when presented as gift. As we know from other historical examples, textiles, with their ease of transportation and the added value incorporated in them, supported land and overseas networks and contacts, like those of the Mycenaeans, and mighty empires, like that of the Assyrians.[19]

Let us see what is known of the social stratification of Akrotiri. At first blush, the archaeological record does not give the impression of any significant inequalities. The houses of the excavated area all have their share of both luxury goods and everyday vessels. If there were any archaeologically detectable inequalities in the way of life, they would have been in other districts of the town. Nothing of this kind can be discerned in the part excavated to date. However we know that social stratification is one of the characteristics of urbanization and that one crucial point is the internal and external exchanges and the way in which they are made. Here, again, no

significant inequalities can be detected. The archaeological picture is of well-regulated general transactions. At Akrotiri, a pre-monetary and a non-market economy, everything is counted and measured. Every vase, every vessel follow a scale of volumes and capacities probably to facilitate the exchanges.[20] For this to happen, there certainly had to be an abstract scale of values and capacities. Only in this way could barter operate smoothly, as it seems to have done. None of this vast number of everyday transactions was recorded, however. They were ephemeral, defined by standard weights and measures, known to all and not recorded. There is not a shred of evidence that this detailed system of values that was the foundation of bartering led to any centralization, and therefore, a redistribution of goods. Not a scrap of the Minoan palace administration or of its officials' prerogatives can be seen at Akrotiri. Any inequalities must mainly have been in other parts of the town, or between the town and the country.

What place does weaving occupy in this context? Who were the people involved in these transactions? And who were the weavers? First, it should perhaps be said that we do not know whether they were men or women. We normally speak of women on the basis of secondary indications, such as their part in the dyeing process (as one can see in the saffron-gatherers fresco) or on the basis of the much later Mycenaean tablets.[21]

Weaving workshops were located on the upper stories. The looms were in the central room of the house, as in Homeric descriptions.[22] Weaving was delicate work and needed light. Room 3 in the upper storey of the West House, which is thought to be a weaving workshop due to an intense concentration of loom-weights, is a central room of the house with a large window looking onto the street. Most of the internal traffic in the house passed through this room. On the basis of the architectural evidence, one can speak of the prominent position occupied by the weaving workshop in the house, and the status of those who worked in it was therefore by no means inferior.

Thus Akrotiri seems capable of supporting craft industries and overseas adventures. Exchanges were made without the need of a large administration, because the sums were small, relations interpersonal and direct, and the storage-time short. Trade was based on surplus production and on the skills of Akrotirians at sea.

Under these conditions, textiles formed an easy medium, both as object and medium of exchange: they facilitated barter. They assisted in the exchanges of other goods of which we have no knowledge.

Finally, I would like to advance a hypothesis. I believe that weaving production operated in a context involving some kind of women's cooperative, similar to a guild. By this I mean an articulated group with an objective and an internal way of functioning, in which the duties would have been shared, as would the gains, possibly according to the skills of the participants. This collectivity would have been based on different kinds of relations, involving kinship or age–a way of life that would have extended beyond work. I have two arguments in support of such a hypothesis. One is drawn from the iconography (Fig. 31.4). In the well-known wall painting of the saffron-gatherers, the girls gather the flowers in similar baskets, and deliver them to a collective basket. It seems that each crocus-gatherer was expected to amass the same quantity of flowers. That may therefore indicate a mode of collecting and delivering that functioned on the basis of equality and inside a collective group, since the products of each individual are disposed communally in a common basket.[23] And if this is true for the dye-stuffs, why should this not also function in the whole cycle of cloth-making? Members of the collective, of different ages and skills, undertake to transform the fibers into beautiful garments or to any other cloth needed. This could also explain the sporadic presence of implements in different parts of town, since complementarity is a basic principle of any cooperative. The other argument is that both in Homer and in the Mycenaean tablets, reference is invariably made to collective groups of women weavers. Their good reputation, too, is collective. We hear of the Sidonians[24] and the Phaeacians[25] which were as good weavers as their men were excellent seafarers. The Linear B tablets refer to women from Lemnos, Knidos, Chios, Miletos.[26] These are collective ethnic names and nowhere is there mention of individual weavers. These women are considered to be captives. It may be so, but this does not invalidate the argument. They may have been members of a collective in their land of origin and much praised for their skills, or they may have shared the same specialization. One should also point out that these ethnic names as well as the Homeric ones tend to refer to ports: weaving was an activity carried out in places

where their products could easily be traded.[27]

I think that there is much in favor of my hypothesis regarding the organization of the production. But what happened next? After the ships had been loaded and put to sea, carrying the men of Thera to distant lands–to Crete, Egypt, Cyprus, or mainland Greece–life in the town continued normally. Other textiles were woven. Sometimes the seafarers returned with ships laden with goods, if things went well, or with a loss, if they had encountered difficulties. What share would then be given to the proud and elegant girls that we see gracefully wearing the dresses? For wherever there is a surplus, the means of appropriating it are always close by. How was the risk of seafaring calculated, or the commercial instinct, or commercial relations? What percentage was left for the 'guild'? Valuable 'gifts'? New raw materials? Or just public praise? I have no answer to these questions. But they could not have failed to receive their share, whether actual or symbolic, in various forms. Accordingly, at the end of this review of weaving in an urban context on an island, I shall refer briefly to the symbolic dimension acquired by this activity. Garments and textiles are depicted on two occasions as part of festive rituals–once in the dressing scene in the House of the Ladies, in which one of the adorants offers a garment to the seated figure opposite her (priestess or deity).[28] The second occasion is in the scene of boys from Xeste III, in which one of the two boys is depicted carrying a large piece of cloth.[29] Where is he taking it? Why? Whose is it? Cloth was woven in an everyday context, but apparently a strong symbolism follows. This symbolism pervades and perhaps transcends the usefulness or the exchange value of the textiles, giving or revealing social identities and opening a 'beyond' dimension of which we have just had a glimpse.

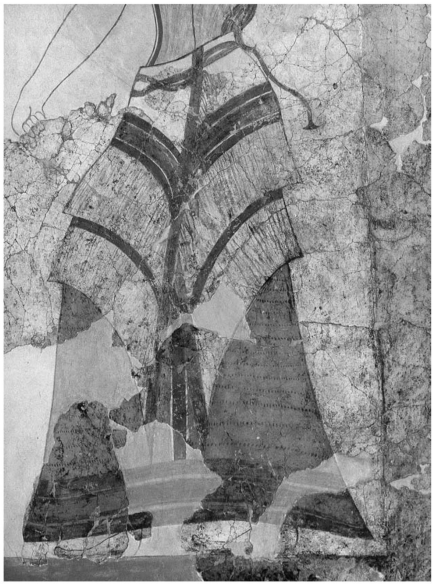


Fig. 31.4: Detail of a garment from the House of the Ladies, Akrotiri.

Notes

1 See Militello, this volume, time frame.

2 However some small scraps of fine cloth were retrieved and examined in summer 2005 by Youli Spantidaki and C. Moulherat.

3 Tzachili 1997, 7–14; Beloyanni 2001.

4 Doumas 1995, 129. In 2003, however, a piece of coarse cloth and pieces of nets were found, Doumas, personal communication, April 2003.

5 Barber 1991, 79–125; Tzachili 1990; 1997, 183–193.

6 Michailidou 2001, 142–148.

7 Barber 1991, 91–113, 387–390.

8 For the densities and the location of these artefacts in the

settlement, see Tzachili 1997, Fig. 92.

9 Especially in the comedies of Aristophanes (for example, *Lysistrata* 574–581); Barber 1991, 283–298, 358–383; Keuls 1980; 1993, Chap. 9; Blümner 1912.

10 Barber 1991, 113–116; Hall 1986, 20; Wild 1988, 36–37.

11 For example, the transparent peplos of the dancing adorant in Xesté III (see Doumas 1992, Pl. 100), or the heavy fabric of the cloaks of the warriors in the fleet wall painting (Doumas 1992, Pls. 35–38), or the multi-colored skirts of the women from the House of the Ladies (Doumas 1992, Pls. 6–12).

12 Doumas 1983, 42–44; Davis & Cherry 1990.

13 Tzachili 1997, 116–117; Andersson this volume.

14 Da-Dg series at Knossos and Cc, Cn series at Pylos. Ventris & Chadwick 1973, 201–208.

15 Gamble 1978; Trantalidou 1990; Tzachili 1997, 29–67. For a possible presence of silk, see Panagiotakopoulou et al. 1997.

16 Aston & Hardy 1990. See also Rougemont, this volume, for flax.

17 Boulotis 1998. For other Linear A inscriptions on Thera, see Michailidou 1992–1993.

18 Tzachili 1997, 20–25; Cresswell 1990; Lemonnier 1989.

19 For an introduction to the Assyrian trade, see Kuhrt 1995, vol. I, 90–95.

20 Katsa 1990; Michailidou 1990; Killen, this volume.

21 As, for example, in Pylos. See Tzachili 1997, 262–263.

22 Tzachili 1997, 183–193; Pelon 1966.

23 Doumas 1992, Pls. 116–130.

24 Homer, *Iliad*, 6.289–295.

25 Homer, *Odyssey*, 7.108–111.

26 See the As, Ab and Ad series from Pylos. Killen 1984, 55–57.

27 Tzachili 2001, 172.

28 Doumas 1992, Pls. 7–12.

29 Doumas 1992, Pls. 109–113.

32 Can a Textile Tradition Survive? The *rebozo* in a Changing Society

by Yosi Anaya

With the paradigmatic upheaval and truncation in structures brought about by the European conquest of the Americas and their subsequent colonization, influences from Europe were rarely welcomed impositions, and oftentimes, selectively incorporated at different intervals throughout the Colonial period. As foreign introductions were appropriated, evolving mestizo traditions in textiles became established, fusing native and foreign influences. These eventually came to fruition in one extraordinary piece of feminine clothing–the rebozo *–in which influences from Europe, the Middle East and Asia merged with the indigenous use of cloth. Tracing the pre-Hispanic origins of the* rebozo *through the many ways it is used in Mexican society by native women, this paper also reflects upon its appearance and manufacture, how it came to represent the Mexican woman, and what it came to represent for her. This garment has undergone a metamorphosis from its indigenous past, through colonial use to a national textile. Although it appears forgotten now, it maintains its indigenous roots. Facing an unchartered future in modernity, the* rebozo *meets its most trying challenge as culture rapidly changes.*

History and Shape

Though women throughout the world use shawls, the origins of the *rebozo* are disputed. My contention is that this *mestizo* garment, although highly influenced from abroad and in time by different modes, has pre-conquest origins that can be traced in the use of the cloth itself, rather than its style. As is well known, with the coming

of the Europeans to the 'New World,' the newly imposed colonial order destroyed previous social, cosmological, and hierarchical structures of native civilizations. In Meso-America, then part of *Nueva España*, it sought to stifle anything that could be associated with previous structures and cosmology, although indigenous cultures continued in spite of this devastating blow. Ways of social dress and behaviour were dictated, forbidding many elements of the previous costumes and suppressing the use of others. The focus of these political-religious dictates targeted mostly the male indigenous population. Although women tended to remain close to the home, there was an insistence that they cover themselves up in public places. Their way of dress–showing bare skin–was seen as scandalous in the eyes of the Europeans, especially by the clergy in their zeal to establish a 'spiritual conquest' as well.[1] The *rebozo* itself, precisely because of these restrictions, is one such garment that developed under colonial restrictions into its present form.[2] Although many influences and styles have acted upon the *rebozo,* the very versatility of its present-day uses by women from marginal spaces of Mexican society testifies to its pre-Columbian origins.

The *rebozo,* a rectangular cloth woven on the back-strap loom, measures usually 80 cm in width, from one and a half to two meters in length of woven material, plus an additional 50-cm fringe on each end made of warp threads. These are terminated in elaborate macramé knotting, known as *rapacejo* (a term derived from Arabic). Certainly this Islamic influence, a fondness for knotted fringes, also had parallels in the knotted, netted garments of priests and initiates in the temple-schools of the Mexica, as documented in the *Codex Magliabechiano* and in the Mayan *Codex Madrid*. Fringes are seen on female tops and skirts in the *Codex Borgia* and *Codex Selden*, among others.[3]

Rebozos are usually of warp-face plain weave *ikat* on cotton. Silk *rebozos* are presently considered the finest, and a limited production is still made in several towns, notably Santa María de Río, San Luís Potosí by descendants of the Otomí, who in other regions of Mexico make and use other warp-*ikat* garments for males and females. The Otomí inhabit diverse regions in several states in central Mexico. Centres were established during the Colonial period dedicated to the production of *rebozos,* where the threads were tied, dyed, woven and knotted. It is interesting to note that this production process

has come to employ men, while the manufactured object is destined for the female population. In Santa María del Río, it is woven on a woman's native loom by men –the back-strap loom, and not on the male-powered, European-introduced treadle loom, which has a greater work capacity.[4]

During the height of the Spanish Empire, trade ships from the Orient, known as *La Nao de la China*, or Manila Galleon, brought goods from China and the Philippines to the Mexican port of Acapulco. An overland route was established for these products to continue on to Spain, setting off from the port of Veracruz. Although this commerce continued over 300 years, these goods as well as some of the people stayed in Mexico.[5] Mulberry silk production had been established in the New Spain, thereby popularising the taste for oriental silk. Also from Manila, silk head-cloths, known as *mantillas*, became popular in Spain. Regardless of their small size, some researchers have attributed the origins of the *rebozo* to these head-cloths worn to church by Spanish ladies. The word *rebozo* as well as *rebocillo* came from Spain, where they denominated the small scarf-like cloths used in mainland Spain and larger ones in Majorca, where a variety of *ikat* exists.[6]

The use of warp *ikat* on the *rebozo* is a striking characteristic. This technique, of course, is found in many cultures throughout the world. Indonesia could have had the same commercial links with the trans-Pacific silk trade route as the Islam nations did in the Mediterranean. Resist-dyeing nonetheless existed among some of the Chichimeca and Otomí tribes in the territory inhabited at present by the Otomí, in northeast central Mexico, prior to the arrival of the Europeans. This is documented in some of the codices, which depict tribute being rendered in the form of spotted-dyed mantles. These can be interpreted as a tie-dyed or *shibori* technique, and further study would have to definitely prove whether these could also be considered *ikat*, *jaspeado*.[7] It is worth noting that most *rebozo* centres were of Otomí populations. That is, one could acknowledge these people as leading *tintoreros*, dyers, who successfully established and adapted themselves throughout different parts of central Mexico. Emigrations, often mobilised by colonial rule, Chichimeca-Otomí settled in Santa María del Río, in Paracho, in Moroleón, Uriangato, and other settlements in the states of Mexico, Puebla, and Tlaxcala. This history is one that still has to

be researched regarding the *rebozo*, as well as its links to similar shawls in the Andes, including neighbouring Guatemala.[8]

Ikat and Serpent

Mexican *ikat* portrays serpent skin. With the exception of some old, unusual designs, there are no figure-like images as in Indonesia, India or Guatemala–only the apparent rhythm of small, scale-like patterns. There are variations in the patterning as well as some subtler monochrome spotting. It is highly symbolic that in Mexico, women should wrap themselves with a 'snakeskin,' a snake's visual and woven image on cloth, as another skin on top of their own. In Mexico, the land where one of the most important deities was the plumed snake, Quetzalcoatl, snakes were important enough to be sculpted on stone, depicted in murals, and represented in textiles. This animal symbolised power, fertility, and cosmic order. Depicted in the national flag and Mexico's official emblem, the snake continues to be an important symbol in the imagination of Mexicans. Even the nation's founding myth incorporates the eagle and serpent, from Aztec wanderings to the consequential founding of the capital city. Its image in pre-Columbian art as well as in native lore embodies fertility and the power of the earth, including the power to bring the rain. Thus, the *rebozo* is much more than a mere head cloth or a shawl. With its snake-patterning, it becomes everything that is woman: the ancient god and/or goddess, a symbol of fertility and cosmic cycles, shelter, a cradle, a bag for flowers or fruit, maternity clothing and child-sling. It is her protective principle in life. It is also her burial shroud. No other textile has such diverse uses.

The traditional colours of Mexican *ikat rebozos* are many. Basically, they can be the colours of snakes- sepias and blacks on a white ground or light specks on a dark ground. Yet in other regions, deep indigo (native also to MesoAmerica) has been the ideal hue. Black *ikat* of different intensities and patterns on white ground is widely spread. Blue is sometimes combined with sepia and white or with black and white. Red with black, purple with black and green with black on white grounds are alternative colour combinations. The simple, warp-face cotton weave is characteristically light yet strong, flexible and wind-resistant. There are also many more colour variation–solid-coloured *rebozos*, coloured stripes, and

textured weaves in different regions throughout the country. The *rapacejo* is very important, for the quality of the *rebozo* is judged by the knotting. In the fabrication of fine *rebozos,* this demands a more tedious and longer process than the weaving itself. Usually, a specialised craftsman works on the knotting. The macramé work is delicately and elaborately knotted, utilizing the colours of the dip-dyed warp threads. There are examples of beaded *rapacejo* from the 19th century, as well as of silken pile knots in the fringe, reminiscent of feather-work. Both the different *ikat* designs as well as the diverse knotting patterns have particular names. *Rebozos* for all occasions are manufactured. And some, more than others, are valued.

Emblem and Woman

In the Colonial period, women from all walks of life were continuously portrayed wrapped in *rebozos* of all sorts. It was a fashionable garment, made of many qualities and fibres. During the Mexican Revolution, a people's movement which produced upheaval, migrations, confusion and death, as well as a change of government with subsequent reforms at the beginning of the 20th century, women played an important role. As well as feeding and entertaining their men, they fought alongside them. They travelled on the railways throughout the country, always with their *rebozo* over the shoulders and across their chest. Its presence was so evident in the Revolution and post-Revolution that the prominent figure and painter, Dr. Atl, considered that it could serve as the national flag–a public recognition of the importance of women in society.[9] Until several decades ago the majority of Mexican women in the countryside and pueblos possessed a *rebozo*. It was a prized garment. Now, rarely is it seen, and its presence seems restricted to gala occasions where traditional native dress is displayed, or to women in villages and countryside where its custom is still upheld, especially amongst elderly women as daily wear. In special celebratory events as well as folkloric fiestas, they are brought out and worn proudly by girls and adults.

Mexico is on the threshold of constant and unprecedented change. Many traditions are changing, and in some cases, being erased. Native peoples are marginalized, for they are a reminder of something that 'we do not want to be', and yet are: Native

Americans. Somehow the predominant European or world culture appears to be superior–'what we strive for, whose image we want to reflect'–a historically imposed view. Now, just after the turn of the century, with a shrunken national culture and a challenged cultural identity, Mexico's path as a nation is questioned. Its future seems chaotic, heading for change in all aspects, forsaking the movement in cultural traditions and becoming one with the globalized mass of consumers. The way of socializing–making human contact, relating to the world, celebrating and eating–seems to be one of the more resistant of surviving cultural traits. Yet these are but a part of that big jigsaw puzzle that is Mexico. A sense of 'cultural belonging' cannot endure if either manifestations of idiosyncrasies that are different from the mass market are undervalued or the ethnic groups, who contribute to the diversity are not taken into account. Textile traditions are but a part of that giant puzzle of the cultural imagery, which is changing dramatically. They are but a small part, perhaps, and the *rebozo,* an even smaller part: a woman's garment, yet certainly a positive, cohesive element.

Notes

1 See Beauregard, Aquino & Anaya 1995–96, 18–19. Also Campos & Castelló Yturbide 1990.

2 Davis 1991, 311. Further elaboration on the commentary by Martínez del Río et al. 1971, 9. The deficit in the population caused by imported disease plus the restrictions banning the use of native garments by the *criollo* and mulatto populations opened the way for the development of *mestizo* garments. The vacuum left by these allowed for the evolution of the *rebozo.*

3 Macazaga Ordoño 1983. Includes various drawings of these textiles extracted from the codices. Also see Rieff Anawalt 1981.

4 Some *rebozo* weaving centres, such as Tenancingo, have switched to the upright looms. Nonetheless, away from the established centres, women wove and continue to weave *rebozos* locally on the back-strap loom, as in the case of the Meseta Tarasca, where the *rebozos* do not have the *jaspeado,* but are of wool with thin blue stripes.

5 Small numbers of males from the Philippines (also part of the Spanish Empire then), China, and other parts of the Orient were imported as labour. The Spanish also took male *indígenas* on the *Nao* sailing westward from Mexico, to the remote province of the Philippines.

6 In Majorca, a present-day *ikat* production of large-patterned cloths woven on a treadle loom still exists. These can possibly be traced to the spread of Islam along the Mediterranean. It should be noted that peasant cultures in Northern Europe, such as Finland, developed *ikat* in imitation of Eastern silks for the way they shined.

7 Further speculation can lead to pre-Conquest links within the Southern Hemisphere to Andean cultures given that there are definite examples of cultural exchange.

8 The indigo *ikat* shawls of Ecuador bear a striking resemblance to the *rebozo*, although their use has not taken the same diverse routes as in Mexico.

9 Castelló Yturbide et al. 1971, 8.

33 Political Affinities and Economic Fluctuations: the Evidence from Textiles

by Nettie K. Adams

Areas such as Peru and Egypt that have a dry climate and strong textile traditions have yielded many thousands of textile remains from individual sites. These collections present us with an almost complete picture of the uses of cloth within a given population, and if there is an extended period of occupation, changes in textiles through time can be plotted. In Egyptian Nubia the fortress-city of Qasr Ibrim[1] *is one such site. Excavated under strictly controlled conditions, over eight field seasons, through 2000 years of occupation deposit, Qasr Ibrim has yielded thousands of textile fragments. In addition to the cultural and historical understandings individual textiles can bring, each one can be classified as a member of a specific group. The resulting classification provides an unparalleled opportunity for numerical analysis. Three studies will be presented, illustrated by graphs and charts. The first is based on 12,061 specimens and shows how the frequencies of the three major cloth fibers, flax, wool and cotton, varied through 2100 years of occupation at Qasr Ibrim. Study two takes six imported luxury fabrics and traces their distributions through space and frequencies in time. A third analysis demonstrates how the frequencies of an inferior, locally-made cotton cloth varied through the last 300 years of the life of the site. The latter two studies are based on 26, 164 textile specimens from the final 300 years of occupation.*

Introduction

In the world of social relations, nothing signifies who we are so

consistently as the way we adorn our bodies. Whatever is most important to our sense of identity, whether it be nationality, ethnicity, religion, or social class, is most likely to find expression in our attire. An entirely non-verbal code of communication is thus created to let those we meet know who we are, what we believe in, often where we come from, and very importantly, how we are to be treated.

This is no less true for the past. Almost anyone can instantly recognize an ancient Egyptian from drawings or a Roman from sculpture simply by looking at the clothing they are wearing.

However, a methodology must be devised for arriving at the kinds of understandings that bring meaning to the ancient textiles. Those of us who have excavated in very dry areas such as the Nile Valley above the flood plain or in Egypt's eastern desert are faced with an overwhelming abundance of textiles. How are such numbers to be dealt with? This is the situation that Elisabeth Crowfoot and I faced together for five seasons at the archaeological site of Qasr Ibrim.

The Site of Qasr Ibrim

Qasr Ibrim is located on a bluff high above the Nile River in Egyptian Nubia, about 30 miles north of the Sudanese border (Fig. 33.1). It was a powerful fortress-city, dominating the area for many miles both upstream and downstream. This strategic location must have attracted settlers from very early times: we know that Qasr Ibrim was continuously occupied for at least 3000 years, and was only abandoned finally in 1811 AD. It was the long occupation coupled with amazing organic preservation that presented a challenge in devising a system to deal with such quantities.

Fig. 33.1: Map showing location of Qasr Ibrim.

Methodology

We decided to analyze and record every fragment of textile, no matter how small. In the 1980 season alone, this number totaled 23,432 specimens, and other seasons have yielded similar numbers. We devised a form on which to record the textiles from each provenience or location. The form includes spaces to record all the basic features of woven cloth: fiber, direction of yarn twist, weave, thread count, color, borders, and the numbers of fabrics in the group which answer to that description. Space is left for comments to augment or clarify the tabulated description: stripes are recorded by counting the number of warps which compose each stripe; checks or plaids are analyzed in the same way, using both systems of warp and weft. Often we sketch a pattern. Our ultimate aim is to produce a description sufficiently complete so that a weaver could reproduce each piece that has been found.

After a few weeks of working with such numbers of textiles, we began to perceive that certain fabrics coalesced into types. Much of the cloth was produced in workshops where the fabrics were standardized and could be readily recognized. It took some time to write type descriptions, but our resulting typology was time well spent. Having type designations to record instead of writing out a description for each specimen saved much time.

In addition to undergoing the initial analysis just described, certain specimens were also catalogued. These were the best

examples of particular fabric types, the best-preserved and the most unusual textile fragments. Catalogued specimens were given a number, measured, cleaned, photographed, possibly drawn, and mounted for safe travel to Cairo. The cata- logued textiles in 1980 numbered 525, or slightly over 2% of the total number of textiles recorded. The uncatalogued specimens, none of which was unique or unusual, were reburied at the site.

These numbers have allowed us to do the same kinds of quantitative studies that archaeologists have long brought to the study of potsherds. Quantitative analysis, in which the textiles are viewed not as individuals but as members of a population, is a useful way of addressing questions of variation regarding fibers and fabric types over time and space. Using percentage frequencies, I have been able to construct graphs and charts which help to organize this vast body of material.

Study 1

The first study, of 12,061 specimens, shows the fluctuations of the frequencies of the three major fibers of flax, wool and cotton over a period of 2000 years (Fig. 33.2). In order to understand the meaning of some of these wide variations, some knowledge of the history of Qasr Ibrim is in order.

The earliest level from which we have textiles dates to the Ptolemaic period (c. 332–30 BC). In these levels, more than 90% of textile specimens are of flax. It was the dominant fiber of ancient Egypt, and continued to be used in Ptolemaic times as well.

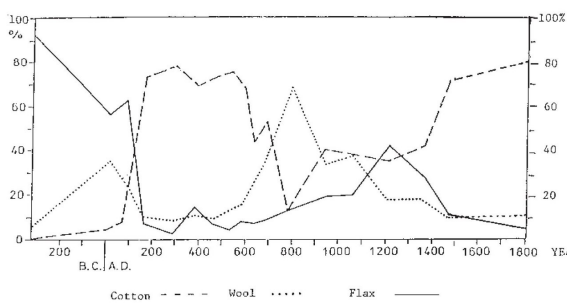


Fig. 33.2: Frequency variations of three major fibers through time.

In 30 BC, Egypt was conquered by Rome, and Cleopatra, the last of the Ptolemies, perished. Seven years later the Romans established a garrison at Qasr Ibrim. Our textiles reflect their arrival by a dramatic increase in the percentage of wool. The use of wool was known, but not favored by the dynastic Egyptians; it was only with the coming of Roman forces that wool became a major textile fiber at Qasr Ibrim. Nevertheless, during the period of Roman occupation, which lasted about 125 years, flax continued to be the dominant fiber, used for furnishing material as well as for clothing worn by the local population.

With the departure of the Romans from Qasr Ibrim around 100 AD, the city came under the influence of the Kingdom of Meroe, located farther south along the Nile in the Sudan. Meroe had an extensive cotton industry, and, in fact, introduced the fiber to Egypt. During the following span of roughly four-and-a-half centuries, the use of flax and wool decreased dramatically, and cotton made an appearance on a large scale. With the collapse of Meroe around 350 AD, the cotton industry gradually declined and then its use plummeted around 550 when Nubia converted to Christianity.

During the early Middle Ages, cultural influences, along with Christianity, came to Qasr Ibrim again from the north. The use of cotton was replaced by wool. Wool and flax were the two fibers most prevalent throughout the Mediterranean world. Sometime around 800 AD, the use of cotton began to increase again. This may be an indication of the early beginnings of an Egyptian cotton industry, so important to the Egyptian economy later on.

The later Middle Ages at Qasr Ibrim were a time of wealth and influence, as indicated by the large numbers of imported luxury goods. Decorated pottery, glass vessels, art objects of metal, wood and ivory, as well as religious texts with elaborate decorative leather bindings have been found. Quantities of imported linen cloth also appear among the textiles at this time.

The last 400 years of occupation can be characterized generally by a continuation of the trends of the preceding centuries. However, we know that near the end of occupation, there was a severe economic decline, which is not revealed by this graph. To see evidence of this poverty, we will turn to more sensitive data.

Ottoman Period

During the last 300 years of occupation, Qasr Ibrim came under Turkish rule when the Ottomans conquered Egypt in 1517. They established a garrison on the citadel and constructed barracks, storage pits, armories and a stable. A number of weapons, as well as other imported items such as Chinese porcelain, have been recovered, including quantities of luxury fabrics.

The Ottoman era falls into two periods: Period I, 1556–1583, and Period II, 1583–1812. These two time spans are recognized archaeologically in the stratigraphy, and have since been confirmed historically.

Study 2

Using the same numerical procedure as described earlier, I have selected six imported luxury fabrics to analyze for the two Ottoman periods. The first is fustian, a cloth with a flax warp and a cotton weft, used mostly for cushion covers. The second we call 'cap weave', a specialized wool fabric used for small, close-fitting men's caps, jackets and vests. Three others are fabrics of pure silk, wool-pile carpet fragments, and resist-dyed or block-printed cotton cloth; these were probably the three most expensive of the imports. The sixth luxury fabric, which we call silk mix, occurs in two types. One has a silk warp and a cotton or flax weft. It is warp faced, and the heavy weft produces a ribbed texture. The other type of silk mix is basically flax or cotton fabric with the addition of silk warp stripes, often as a decorative selvedge.

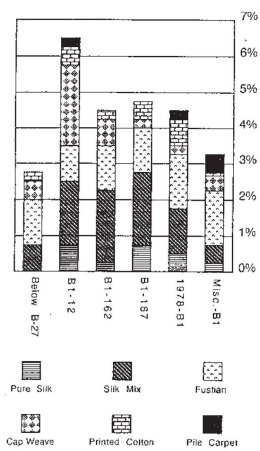
The twenty-seven years of Period I are represented by six excavation units containing a total of 8,770 textile specimens (Fig. 33.3). The combined percentages of the six fabric types from the six excavation units present us with a high of 6.3% to a low of 2.7%. Furthermore, the unit with the lowest total percentage ('Below B-27') completely lacks two of the luxury fabrics: pure silk and pile carpet.

For the analysis of textiles in the 229 years of Period II, I took four neighborhoods containing a total of 15 houses (Fig. 33.4).

These 15 houses contained 17,394 textile specimens. During this period there seems to be a greater range of variability among neighborhoods and among individual houses than was true of the earlier period. Only neighborhood B contained any pile carpet; the two smaller neighborhoods C and D had no printed cotton or pile carpet and lesser percentages generally of luxury fabrics than of the two larger units.

An interesting comparison with Period I is found in the combined percentages of the luxury fabrics from each house. In the earlier period, only one of the six excavated units had less than 3% luxury fabrics; in Period II that figure climbs to 40%. A further comparison reveals that two-thirds of the units of Period I contained 4% or more luxury fabrics; in Period II that figure dropped to only one-fifth of the units with 4% or more luxury goods. The decline in luxury fabrics becomes even clearer when the frequencies of all the luxury fabrics are averaged for the two periods. For period I we arrive at a figure of 4.3%; and for Period II, 2.7%.

Fig. 33.3: Frequencies of six imported fabrics: Period I.



The *progression* of the decline of luxury fabrics throughout the 229 years of Period II can seen in Fig. 33.5. The graph shows time proceeding from left to right; the earlier stratigraphic levels are on the left. Although the percentages fluctuate, the trend is clear: there is a marked decline in imported luxury fabrics as the story of Qasr

Ibrim was drawing to a close.

Study 3

The majority of cotton fabrics from the Ottoman Period have yarns spun in the Z direction (Fig. 33.6). They were imported from Egypt in several standardized types from which much of men's clothing was made. A locally-made cotton cloth is a poor substitute, and is readily distinguishable from the Egyptian types, by its S-spun yarn (Fig. 33.7). This fabric appears only during the Ottoman Period; it is totally absent among the textiles dating to earlier times at Qasr Ibrim.

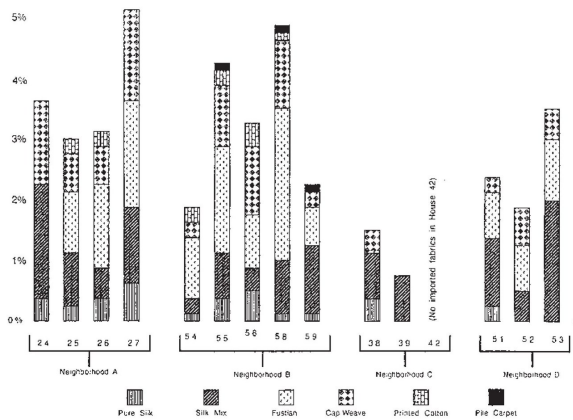


Fig. 33.4: Frequencies of six imported fabrics: Period II.

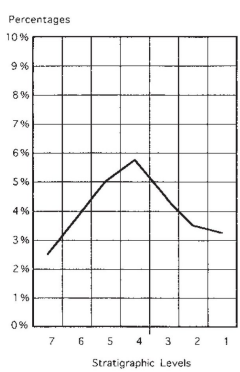
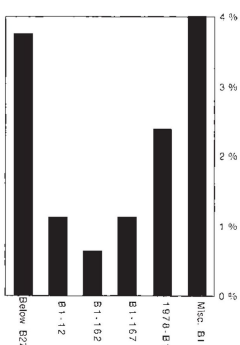


Fig. 33.5 : Decline of imported fabrics throughout Period II.

Fig. 33.6 : Imported cotton fabric: Z-spun yarns.

Fig. 33.7: Locally-made cotton fabric: S-spun yarns.

Fig. 33.8: Frequencies of locally-made cotton cloth: Period I.



Looking at the percentages of this locally made cloth type in the six Period I units, we see a variation between 0.6% and 4% among them (Fig. 33.8). Furthermore, the three units containing the lowest percentages of this fabric are the same ones which show the highest percentages of luxury fabrics.

In Period II (Fig. 33.9), the figures vary between 2% and 19%. This represents a dramatic increase in locally-made cotton fabric

since Period I. Among the six earlier units only one had as much as 4%; four of the remaining units had less than 3%. In Period II, we see that 8 of the l5 houses contained 10% or more of the locally-made cloth. The negative correlation between luxury fabrics and locally-made cotton cloth that was found in Period I is replicated in Period II. Neighborhood C with the greatest percentage of locally made cotton is also the one with the fewest luxury fabrics. The *progression* of the increase of the homemade cotton cloth throughout the 229 years of Period II can be seen in the next graph (Fig. 33.10). Again, the earlier stratigraphic levels are on the left, and proceed in time to the right. A comparison of this graph with Fig. 33.5 reveals the same negative correlation between imported luxury fabrics and locally-made cloth.

Conclusion

How do these three textile studies contribute to our understanding of life at Qasr Ibrim? Have we really learned anything about the people, or just about the fragments of textile refuse?

In the first study, the wild fluctuations of the percentage frequencies of the three major fibers reflect the changing fortunes of Qasr Ibrim throughout 2000 years of history. First, it was dominated from the north by Egypt and by Rome. With the decline of these influences, the Kingdom of Meroe extended its hegemony to the north, introducing its own fiber, cotton. With the collapse of Meroe, its influence, along with that of the cotton industry, declined, and Qasr Ibrim, by adopting Christianity, again became part of the Mediterranean world

Fig. 33.9: Frequencies of locally-made cotton cloth: Period II.

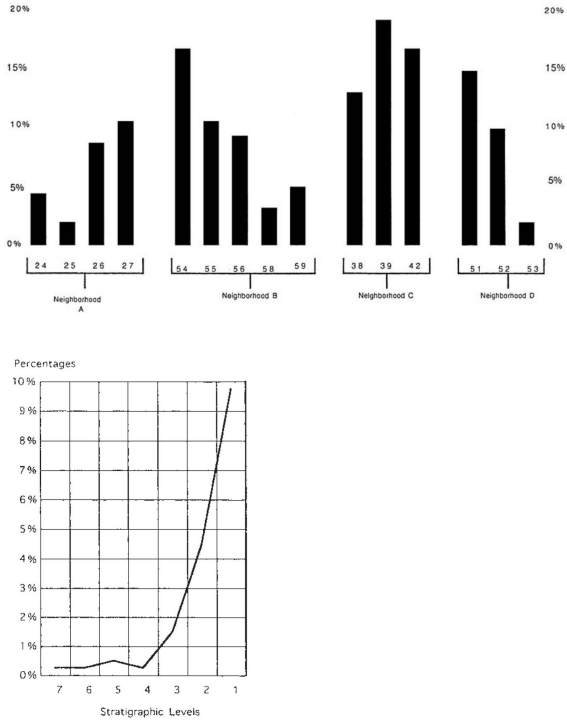


Fig. 33.10: Increase of locally-made cotton cloth throughout Period II.

Studies 2 and 3 trace the wealth, especially in luxury fabrics, brought to Qasr Ibrim by the Ottomans. But when governmental support of the garrison was abandoned, the inhabitants were no longer able to import luxury goods, or even good quality cotton fabric. In their poverty, they were forced to produce a homemade cloth which was greatly inferior to the imported types. From these three studies, it seems clear that quantitative textile data can be accurate indicators of political affinities and economic fluctuations.

Notes

The material for this paper was first prepared for the conference 'Numerical Methods in Archaeology' sponsored by Humboldt University, German Democratic Republic, 1983. It has been adapted for the conference "Ancient Textiles: Production, Craft and Society" from an article in *Approaching Textiles, Varying Viewpoints,*

Proceedings of the Seventh Biennial Symposium of the Textile Society of America, Santa Fe, New Mexico, 2000.

1 Excavation at Qasr Ibrim has been carried out since 1961 by the Egypt Exploration Society of London under license granted by the Egyptian Antiquities Organization.

34 Clothing Patterns as Constructs of the Human Mind: Establishment and Continuity

by Elizabeth Wincott Heckett

In the use of clothing, certain patterns seem to persist over long periods, although some changes in shape may occur over the centuries. In any specific time period, there are clear concepts of the 'correct' way in which a particular garment should be made. For the last 1.4 million years humans have been able to develop and retain in their minds a mental template or construct of whatever artefact they plan to make. These factors are also seen in other types of artefacts but the insistence on patterns can be very clearly discerned in clothing. Indeed in modern times, we are so specific about patterns that advanced computer programs make up very accurately graded models for commercial production. But only as recently as forty years or so ago, the traditional European professional dressmaker with her knowledge of dressmaking and her mental construct of a particular gown could copy perfectly a Paris couture dress from a photograph within a fashion magazine.[1]

Origins of Mental Constructs

The concept of patterns or templates held in the mind that dictate the physical form of a particular artefact is an integral facet of human behaviour. People have evolved a process of mentally sifting and grading information into specific constructs so that artefacts are not made in a random way within a particular culture, but conform to sets of rules in different times and cultures. This is, of course, the premise on which typology, the old, favoured archaeological method of dating, is based. Within a typology, three periods in the

life of an artefact can be classified. The development, flowering or *floruit* and decline of a class of pottery, for example, can be charted and identified through similarities in pattern. It also appears that humans transfer information and techniques from an artefact made from one type of raw material to another with the same function, but in a different material. For example, this happens when people start to use metals like copper and bronze rather than stone. The first metal axes clearly mimic the form of the preceding stone axes; early copper axes in Ireland were cast in a mould that is exactly the same shape as a stone axe. The concept of the Neolithic stone axe was so strongly imprinted within their minds that it took many years for people to realize that the new raw material, metal, had different properties compared to stone. About 800 years passed before the mental concept changed, and bronze axes began to be cast with sockets for the handles.[2] This belated innovation was a great improvement upon the way stone axes were tied onto handles, for the axe and haft came apart far less frequently during use. In the same way early cloth or skin patterns may persist for a long time despite changes in raw materials or techniques.

From very early times humans have had the ability to hold in their minds a pre-formed construct of how they require a particular artefact to be made and how it should look. Between 1.4 million years and 100,000 BP, in many parts of the world Early Humans (*H. erectus,* archaic *H. sapiens* in Africa and China*, H. heidelbergensis, H. neanderthalensis*) made the ubiquitous stone hand-axe. This implement is the earliest example of humans imposing a specific form onto an artefact, in that the raw materials used were very diversely shaped stone nodules. These were worked so that symmetrical hand-axes of a specific recognizable form were routinely produced. Steven Mithen has comprehensively explored the development of the human mind. He states, 'There can be little doubt that in terms of understanding the fracture dynamics of stone, and putting that understanding into practice to make stone artefacts conforming to a series of preconceived mental templates, Early Humans possessed equivalent abilities to Modern Humans.'[3]

Clearly this type of behaviour, working from a series of preconceived mental templates, is strongly rooted in human society. Equally it seems that no organic remains survive from these early periods so, as people interested in textiles, we can do no more than

note with interest how early in our prehistory a behaviour occurs and how deep-seated it is. The inference that can be drawn from this information is that humans have no problem holding an abstract concept in their minds as to the 'right' or 'correct' way of making an object. Long before people made drawings, cut notations on sticks or perhaps communicated with each other, the idea of a pattern to which an artefact should conform was part of the human psyche.

Patterns in Cloth and Clothing

In relating this form of behaviour to the making of clothing, some other concepts have to be taken into account. These are concerned with the raw materials from which clothing is made, whether it be animal skins or woven and netted cloth. Seminal work in setting out the parameters of such studies was carried out by Margrethe Hald and Dorothy Burnham.[4] In their work the hypothesis is put forward that the forms of the skin and of the loom-piece dictate the shape of the clothing. This is clearly true on one level of understanding. Relatively recent examples might include a reindeer skin used in its entirety as a child's coat and hood by the Evenki people of southern Siberia (Figs. 34.1 a and b). Also, there are the many categories of rectangular wool or linen loom-pieces wrapped and/or sewn into pre-Industrial Europeans' cloaks, skirts, aprons, shawls and caps. However, it must also be noted that although far less flexible than cloth, the skins of small mammals can be manipulated at will into many shapes of varying sizes.

Figs 34.1 a (top) and b (bottom): Child's coat and hood of reindeer skin, Evenki people, Siberia, 1990 (author's photographs).

Another important dimension to be considered is the shape and size of the human body, and the range of movements and activities undertaken by men, women and children. The flexibility of cloth is particularly comfortable and suitable for active wear.

Considerations other than the utilitarian enter into the formation of the mental template: these include moral and social attitudes, and the vaguer concept of whether a garment is considered 'correct' or 'right' by society for a particular human situation. In many societies today, the clothes chosen for a wedding celebration are not acceptable for mourning, or indeed for a business meeting. These particular choices may last for many years, and gradually drift into obscurity. In the late 20th century in many parts of Europe and North America, women of all ages shifted into wearing trousers in almost every life situation and on a daily basis. This marks the end

of the obligatory wearing of skirts, considered the only appropriate type of garment for women in Europe certainly for the last 2000 years and probably much longer.

In moving from the abstract to the concrete, the following points may be considered. The technology of producing clothes does seem to have been pattern-based from the time that such representations occur. Elizabeth Barber has authoritatively discussed the history of the female string skirt that is first seen on Upper Paleolithic 'Venus' figures of about 20,000 BC; these skirts certainly seem to be concept based.[5] It is much the same pattern that persists in Danish Bronze Age skirts from Egtved and Ølby.[6] At least until the beginning of the 20th century, the Khoisan women of southern Africa wore string skirts ornamented with ostrich egg beads.[7] Finds from the Later Stone Age (20,000–10,000 BC) at Nelson Bay Cave and Boomplaas Cave, Southern Cape, included ostrich shell and bone beads. The Khoisan people are now deemed to have a DNA structure linked to the first Modern Humans and have certainly occupied southern Africa far longer than any other *H. sapiens sapiens* groups.[8]

Example of Rectangular Cloth Piece Patterns

The specific 'rules' for making caps in Viking Age Dublin, Ireland, and York and Lincoln, England can be illustrated from examples made from both wool and silk.[9] The caps are made from a rectangular cloth piece, folded in half and sewn down the back. They belong to the group of traditional European garments of basic rectangular shape already noted. So far, the wool caps have been found only in Dublin, while silk examples of a smaller number were excavated in Dublin, York and Lincoln, all at Viking Age settlement sites. A line of stitching at the top of the back defined the curve of the head, and is typical of the pattern used at all three sites. Two very similar types of silk cloth were used to make caps in the three settlements.[10]

It seems that the wool caps may be the originals for the pattern since the silk examples have been cut down in width to correspond generally with those made in wool. The wool caps may often have both selvedges present, but none of the silk pieces does so: the deduction may be drawn that in each instance a larger piece of silk has been modified to fit in with the mental construct of how the cap

‘should’ be made. Bigger pieces of silk at the same Dublin sites were used for scarves, but seemingly a choice was made that cap sizes should stay within certain parameters. There were also different concepts of what a cap should be and what a scarf should be. From the 13th century onwards throughout Europe a simple cap became general wear; it may well be that the very similar pattern echoes that of the Hiberno-Norse pieces, but with the peak defined by the curved seam now eliminated, or residually hidden inside the cap.

Patterns Based on Animal Skins

Another type of pattern with a long history is based on the use of animal skins in human societies. In a modern setting it can be seen that the particular shape of some Ethiopian priestly vestments, now made in silk or rayon cloth, are still cut into the shape of the big cat skins formerly worn by warriors and officials. The skins were worn with the long forepaws hanging down either side of the front of the body, and the tail and rear legs down the back (Figs. 34.2 and 34.3). In the early 16th century AD a Portuguese traveller in Ethiopia, Francisco Alvares, described how imperial courtiers were dressed in white shirts and good silk clothes, while over their shoulders they wore lion skins decorated with collars of gold adorned with jewels and false stones.[11] Some of the robes of the late Emperor of Ethiopia, His Imperial Majesty Haile Selassie (d. 1975 AD), to be seen in the National Museum, Addis Ababa, incorporate fur and skins mounted on cloth but still retain the shape of animals’ bodies and limbs, and were also worn over the shoulders.

34.2: Priests wearing silk/ rayon vestments at Temkat (Epiphany) celebrations, Addis Ababa 2001 (author's photograph).

Fig. 34.3: The procession of the Queen of Sheba to King Solomon's court showing warriors wearing animal skin cloaks; Ethiopian folk art, paint on goatskin 2003 (author's photograph).

It seems that something similar may have taken place in nearby Egypt in the 2nd millennium BC. Vogelsang-Eastwood, quoting from Howard Carter's excavation notes on the tomb of Tutankhamun (1333–1323 BC), notes that the young Pharaoh's clothes included a cloak, a robe and the remains of a robe, all made of leopard-skin.[12] Among the beautiful and scholarly reconstructions of his clothes, recently made as part of an exhibition created by Dr. Vogelsang-Eastwood, was a richly decorated and embroidered cloth

representation of a big cat, perhaps a leopard, complete with a gold head and claws.[13] This garment is small, thus suitable for a young child: it may well have been worn as part of the Pharaoh's dress for an official or ritual occasion (Fig. 34.4).

Fig. 34.4: Reconstruction of cloth leopard-skin with golden head, Tutankhamun's clothes (courtesy of the Weaving School at the University College of Borås, Sweden).

Clothing Based on Semi-circular, Square or Rectangular Patterns

A bog body and its clothes from Clongownagh Bog, Baronstown West, Co. Kildare, Ireland (2nd to 4th centuries AD) can serve as a useful focus to explore both earlier and later types of outer garments.[14] A semi-circular skin cloak (175 cm × 110 cm) and an almost square woven wool cloth (at least 116 cm × 110 cm) were found with the body. The first item can be linked to Bronze Age and Roman secular dress and Christian sacred vestments, respectively; thus, the antecedents and descendants of the semi-circular cloak can

be fruitfully explored. The earliest existing clothing in Europe is of course that of the Danish Bronze Age mound burials dated to the 2nd millennium BC. The male cloaks from Trindhøj (243 cm × 126 cm) and Muldbjerg (231 cm × 118 cm) use the semi-circular shape; the first example is dated to 1347 BC and the second to 1365 BC.[15]

Their published diagrams would suggest that the cloaks were made from one piece.[16] The same pattern provides the *casula, paenula* and *byrrus* of Rome and the provinces, and the chasuble of the European Christian church. The pattern for the early 'bell' chasuble is a semi-circular cloth-piece with the long, straight upper edge folded and sewn together as for a cope except for an upper portion left unsewn for the head opening and hood. Equally, the pattern for the Roman toga, the Etruscan shawl and the Christian cope comes from the same source. Originally all these garments would have probably been woven in one piece, and most likely, on the warp-weighted loom.[17]

By the Medieval period in Europe different looms were being used, but the shape of the cloak still persisted. The 14th-century Swedish traveller buried in a bog near Boksten wore a semi-circular cloak (380 cm × 110 cm). It was made from two full loom widths (one of which is actually made up from two separate pieces of the cloth), plus a small horizontal band shaped to complete the bottom curve.[18] Unlike the Clongownagh cloak with its wide, full length central panel, and two complementary smaller side pieces, the Boksten cloak's three component pieces run the full length of the garment, sewn one above the other. The cloth was in all probability woven, not on a vertical, but on a horizontal loom that produced considerably longer bolts of cloth to specified widths than that of the warp-weighted loom. Again a different technique was adapted to produce the long-established pattern. A substantial semi-circular wool cloak (243 cm × 130 cm) from Meenybradan, Co. Donegal is dated to 730 ± 90 BP, given a 95% probability of dates 1050–1410 AD. This garment is also made up of three horizontal layered panels, much like the Boksten cloak.[19]

The square/rectangular loom-piece can be used as cloak, blanket, tunic or skirt. In the case of the now square Clongownagh cloth, it could be deduced from the remaining pieces that it had probably been worn in life with one corner turned under at the back of the neck; in death it had been put on the corpse the other way, with the

cloak closed with wooden pins down the back. It can be seen that two adjoining sides of the textile were pinned together in a straight line forming the closure. These two surviving fringed pieces are contiguous edges, and the first piece with its folded-under corner represents their continuation to the back of the neck. These form a cone-shaped garment with a distinctive triangular 'tail' (created by the corner opposite that at the neck) showing at the bottom of the back.[20]

The Irish/Scottish tradition of this garment, whether of plaid or plain cloth, has a well-documented history, and persists to this day. The kilt and shawl worn in both countries were originally incorporated into a single, large, square/rectangular cloth piece that was first folded around the lower body, then belted at the waist, after which the rest of the cloth was thrown over the head and shoulders. The unbelted plaid was used as a blanket at night. [21]

Even to the present day, the all-purpose large cloth, now produced by different methods, persists. In 2002, we saw quite frequently on the television the *pattū*, the large rectangular cloak of the Afghani, used widely as a warm covering for day and night. In Ethiopian dress, the rectangular cloak and *shama* are still widely used, both in white cotton and in brightly coloured cloth. The light cotton shawl, the *shama*, used variously as protection from sun, dust or cold, is routinely carried by men and women alike while wearing modern as well as traditional styles of dress. The ubiquitous, larger, heavier rectangular cloth is worn wrapped over day clothes by night watchmen and others against the sharp cold of the night.

As a last reflection on the points reviewed here, the roots of the English and French words for patterns perhaps may be usefully considered. *Pattern* and *patron* are both related to the Medieval Latin *patronus* or patron, hence something to be imitated because it is worthy of respect. A patron is defined as anyone who supports, protects or champions (Middle English *patroun*, Old French *patron*). *Patronus* is from the Latin defender or advocate from *pater* (father).[22] It may be useful to reflect on the resonance of these meanings when we consider the role played by the many and persistent, preconceived constructs we carry so clearly in our minds. Perhaps it is a good way of transmitting information between generations. If they are structured in a particular mode, it may enable us to carry in our minds a greater number of important

pieces of information. It may also help us to categorize the people we meet and assess their relevance to our societies and to ourselves.

Conclusions

The examples of clothing discussed here have ranged from the string skirt, known to have been worn since Palaeolithic times, to the cloaks used by men and women in modern societies like Afghanistan and Ethiopia. The persistence of the use of patterns as a part of human behaviour has occurred in many different cultures and time periods, and indeed from very early in our prehistory. The building of the mental construct that enables us to carry out these plans does seem to be an essential part of human activity. The clothes that we wear serve us in many ways beyond that of keeping us warm and protected. They fulfil diverse expectations that are social, cultural and economic as well as practical. The patterns which clothes are based upon may very well be significant tools in the efficient working of the human mind, and of the complex societies that have grown out of that human endeavour. However many uses of patterns there may be, their development and persistence over time seem remarkable and worthy of serious consideration.

Notes

1 The present writer experienced this in Athens, Greece, in 1961.

2 O'Kelly 1989, 77, 147–167.

3 Mithen 1998, 130–158.

4 Hald 1980, 313–392; Burnham 1973.

5 Barber 1991, 255–259.

6 Broholm & Hald 1940, 33, 35–41.

7 These skirts together with other clothes and possessions of the Khoisan from the early 20th century are displayed in the South African Museum, Cape Town, South Africa.

8 Deacon & Deacon 1999, 108–9, 117–8, 91–93.

9 Wincott Heckett 2003.

10 Walton Rogers 1989, 374–377; Wincott Heckett 2003.

11 Pankhurst 1990, 3, 19.

12 Vogelsang-Eastwood 1993, 156.

13 Dr. Christina Rinaldo of the Weaving School at the University College of Borås, Sweden was responsible for the scholarly reproduction of this and other pieces of Tutankamun's wardrobe.

14 Wincott Heckett 2001, 91–97.

15 Broholm & Hald 1940, 42–44, 56–60, 73–74; Jensen 1998, 65, 115 (I am grateful to Dr. Ulla Mannering for the latter, and following, references).

16 Broholm & Hald 1935, Fig.16, 231; Broholm & Hald 1940, Fig. 8, 14.

17 James 1934, 4–9, Granger-Taylor 1982, 10–22. In her discussion of the statue of The *Arringatore* (The Orator) and his toga, Granger-Taylor addresses the question of the construction of the semi-circular toga. The top straight edge of the cloth constitutes the starting border of the web on a warp-weighted loom. The side selvedges are curved inwards, with the weft picks decreasing in length to create the roughly semi-circular shape. A closing cord down the sides defines the shape. Later, hooded cloaks were probably also woven on two-beam looms, with the same technique. This last could, of course, be used in making any woven semi-circular garment.

18 Nockert 1985, 41–47.

19 Delaney & Ó Floinn 1995, 130–132.

20 Wincott Heckett 2001, 92–94.

21 McClintock 1943, 123–140.

22 These definitions are taken from the *Heritage Illustrated Dictionary of the English Language, International Edition*, 4th edition, 1973, American Heritage Publishing Co., Inc. and Houghton Mifflin Company.

35 *Picturae in textili* on Shoulder Busts in Hellenistic Sicily?

by Antonella Pautasso

> nego in Sicilia tota…..ullum argenteum vas,….signum ullum aeneum, marmoreum, eburnum: nego ullam picturam neque in tabula neque in textili quin conquisierit inspexerit, quod placitum sit abstulerit.[1]

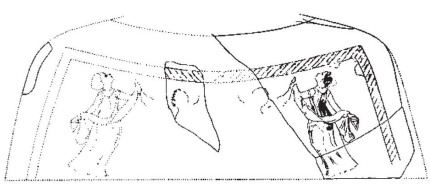
Five female shoulder busts found at Syracuse and Morgantina (Sicily) are decorated with large, painted panels worn over red-purple chitons. The panels show some figured scenes: women performing a dance or, on one example, a complex mythological scene, the rape of Persephone. It is not difficult to assume that the rectangular panel represents a real piece of cloth, perhaps a characteristic part of the dress of a cult statue, as described by the ancient sources. Lastly, how did a possible production of decorated and precious textiles fit into the craftsmanship of late Classical and Hellenistic Sicily?

Female fictile shoulder busts have been found at many Greek and Hellenizated sites in Sicily from the Late Archaic to Hellenistic Ages.[2] Within this large production, five examples are quite remarkable because of the presence of a large painted panel worn over a red-purple *chiton* with the neckline decorated with stylized floral patterns. The *polos* is painted in red or pink; sometimes necklaces and earrings are present; color is preserved also on the hair. The earliest of these five busts (Fig. 35.1a–b) comes from Syracuse,[3] and it shows women performing a ritual dance; a very

similar scene has been found on another bust (Fig. 35.2),[4] probably from Syracuse, now preserved in a private collection. Three painted busts from Morgantina are very interesting: two of these probably have some scenes of women performing a dance (Figs. 35.3–35.4)[5] and the last (Fig. 35.5a–b) is a fragmentary example which shows a complex mythological scene, the rape of Persephone.[6]

One of the most important issues raised by these decorated busts involves the use of the rectangular panel: that is, if it could be considered to be the graphic reproduction of a real piece of cloth. There are some details on the busts and some features of their patterns that suggest such an answer. Firstly, the *chiton* and the accessories, such as *polos*, necklace and earrings, have been reproduced with great attention to detail: e.g., the narrow decorated borders of the dress, demonstrating the painter's aim to reproduce the image as realistically as possible. Secondly, it should be noted that one of the most evident features of the patterns on the first four busts is the symmetry in the figures' placement–much like that of a weaving scheme. It is not difficult for us to think that the painted panel represents a real piece of cloth, made, probably, by the tapestry method[7]–used from ancient times for weaving decorated and figurate cloth, according to some literary, iconographic and archaeological sources.

To see the great specialization of the textile work and the high quality of the decorative work, one can view the textiles of the Hellenistic and Early Roman periods, which looked like painted surfaces, according to Teocritus[8] and Cicero.[9]



b

Fig. 35.1a –b: Bust from Syracuse, with decoration of women performing a ritual dance (Gentili 1959–60, Pl. II 1–3; Syracuse. The fairest Greek city. Ancient art from the Museo Archeologico regionale Paolo Orsi, 1989, 100–101, No. 21).

It is possible that the decorated panel was like the *semeion* of Nikoboule's mantel or the panel on Aristeia's mantel, mentioned in a 4th-century inventory (349–345 BC) of garments and textiles dedicated to *Artemis Brauronia* in Athens.[10] As Wace stated many years ago, the *semeion* was woven into the garment, as the ornamental rectangles woven onto the warps in Graeco-Roman garments found in Egypt, the cloak of *Demetrius Poliorketes* described by Plutarch,[11] or the cloaks in the pavilion of *Ptolemy Philadelphus*.[12] But we could also think that this panel was applied over the garment. There is also strong evidence of decorated panels woven into (or applied over) garments from red-figured vases of the Late Classical period, on the well-known volute-krater of the *Pronomos* Painter from Ruvo[13] (Fig. 35.6), or on some vases by his contemporaries.

It remains to be seen whether this decorated panel could be considered as a distinctive element of a cult statue's dress. From the ancient sources we know that the two goddesses at Syracuse wore the *porphuris,*[14] a holy garment used as a guarantor for the oaths. Therefore the red-purple garment was a distinctive attribute of the Sicilian Demeter, as a painted scene on a polychrome *skyphos* from Lipari[15] shows (Fig. 35.7). In the cult practices of Demeter and Kore, and in many other places of the Greek world, the worshippers wore white and plain garments and the women were forbidden to wear precious jewels, according to the cult regulations.[16]

This is a further proof that the fictile painted busts represent the goddess and the decorated panel is part of some rich and elaborate garment. Such a suggestion seems to be supported also by the fact that the first four busts repeat, even though with some variations, the same figurative pattern, just partly reinterpreted.

Another matter is the fifth bust representing the rape of Persephone, for it is the only known example until now. It does not seem an unimportant detail that the panel with women performing rituals and dancing is connected to the bust–echoing the Classical style–in which the hair and face (typical of a mature woman) remain the same, while the panel with the mythological scene is connected with an acephalous bust, with hair along the shoulders, as the busts of young women, *kore*.[17] This difference, still needing investigation, could be perhaps connected to the different interpretation of these busts: as a couple mother-daughter (Demeter-Kore), or as a double of the same figure in her dual capacity as daughter-bride (Kore-Persephone).

Fig. 35.2: Bust, probably from Syracuse (Hornbostel 1977, 146, No. 116).

Fig. 35.3 : Painted bust from Morgantina (Bell 1981, 140, No. 106a, Pl. 27). Author's photo.

Fig. 35.4 : Painted bust from Morgantina (Bell 1981, 140, No. 106b). Author's photo.

Finally, it remains to be established how this evidence fits into the very scarce historical data about the textile craft in Sicily.[18] In this connection, the documentary evidence, both epigraphical and literary, of the Greek age, is very scarce: there are only some scattered sources about the quality or about the colors of the Sicilian *chitons*.[19] Regarding the archaeology, the problem of the so-called '*piombi mercantili*' (commercial leads) has still to be explained.[20] Nevertheless, we must remember that there were two fields of cultural life and technique in Greek Sicily which would have constituted very important stimuli for the growth of the textile craft on the island: the theatrical tradition and the technology of the nautical furniture. Putting Sicily into the wide trade spheres of the Hellenistic Age could suggest a complex picture of production and exchange of goods, not very different from other regions of the Mediterranean.[21] Moreover, some information about the specializations in textile craft could be found in written and epigraphical data of the Roman Age.[22]

Fig. 35.5a–b: Painted bust from Morgantina with decoration of a mythological scene (Bell 1981, 140–141, No. 106c, Pl. 28, Fig. b). Author's photo.

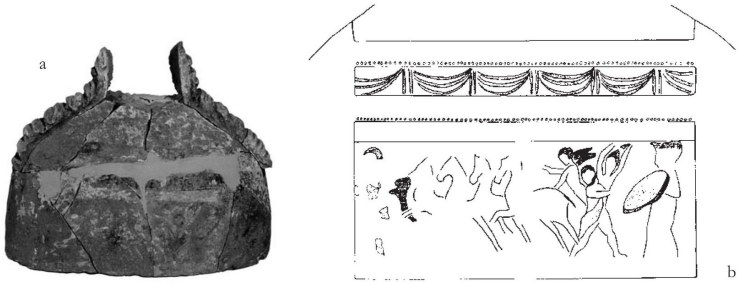


Fig. 35.6 : Vase from Ruvo (Arias 1960, Fig. 218).

Fig. 35.7 : Scene on a polychrome skyphos from Lipari (Bernabò Brea & Cavalier 1986, 56–57, Figs. 57–59).

Notes

This short paper has come out from a wider research about some aspects of the iconography of the votives connected with Demeter and Kore in ancient Sicily. Taking advantage of the occasion, I would like to thank the organizing committee of the Ancient Textiles Conference and my colleague, Prof. Pietro Militello, who presented my lecture poster as I was not able to attend the conference. I owe special thanks to Prof. Elizabeth Barber for suggestions and technical explanations.

1 ‘I say that in Sicily….., there was no silver vessel,….no statue of marble or brass or ivory, no picture whether painted or embroidered that he did not seek out, that he did not inspect, that, if he liked it, he did not take away’, Cicero, *Verr.* II.4. I.I. Translation from www.perseus.tufts.edu.

2 I use the term ‘fictile’ to mean the busts made of terracotta. Generally, on the shoulder busts, see Kilmer 1977.

3 Gentili 1959–60, Pl. II 1–3; *Syracuse. The fairest Greek city. Ancient art from the Museo Archeologico regionale Paolo Orsi*, 1989, 100–101, No. 21. The bust was found during the excavations of 1957–58 in the Akradina district, near the area of the Demeter sanctuary. The panel (badly preserved on the left side and in the middle) shows a dancing woman moving left on the right side, with head thrown back and arms outstretched. She carries a small yellow basket with her right hand, and perhaps grasps the hand of a second dancing figure with her left hand. A yellow sash hangs from her shoulders and between her arms.

4 Hornbostel 1977, 146, No. 116.

5 Bell 1981, 140, No. 106a, Pl. 27. The first shows on the right side a standing woman, moving to her right and extending an object to a woman sitting on a couch. She is holding a round red object, probably a tambourine, propped on her left thigh. Shadows of two other figures, one seated and another standing, are on the left side. The second bust, Bell 1981, 140, No. 106b, is very similar, although here a figure with green wings is standing on the right side. The busts are dated to the late 4th century BC. For the stratigraphical context, see Stillwell 1963, 169–170.

6 Bell 1981, 140–141, No. 106c, Pl. 28, Fig. b. In the center, the *quadriga* of Hades moving to the left. The god is holding the goddess; she is asking for help with her arms thrown over her head. Above the head of Hades is a small winged figure, probably Eros. Athena is standing on the right side, while another goddess (Hekate or Artemis) is badly preserved on the left side.

7 For the tapestry method, see Barber 1991, 358ff. Many years ago, Wace 1952 discussed the difference between in-woven and

embroidery cloths, and he explained, on the ground of the literary and archaeological evidences, that such decorated panels were woven into the garments.

8 Theocritus, *Syracusans* 77ff.

9 Cicero, *Verr*. II. 4. I.I

10 Wace 1952, 113f., with bibliographical references.

11 Demetrius XLI.4.

12 Athenaeus V, 196f.

13 Arias 1960, Fig. 218.

14 Plutarch, *Dion* 56. For the different interpretations of the discussed passage of Bacchilides *Ol*. VI, 92–93 about *Demeter phoinikopeza*, see Vieillefond 1972.

15 Bernabò Brea & Cavalier 1986, 56–57, Figs. 57–59.

16 Mills 1984, *passim*; Dillon 2002, 260–264.

17 See, for example, Bell 1981, 143, No. 116, Pl. 34 (late 3rd century).

18 For some information about the textile craft in ancient Sicily, see Pace 1935, 390–392; Martin, Pelagatti & Voza 1979, 417–418.

19 Alciphron, *Ep*. I. 6; Plato, *Epist*. XIII. 363a.

20 The problem of the commercial leads has been raised by Pace 1935, 391–392.

21 See, for example, Labarre & Le Dinahet 1996.

22 Cicero, *Verr*. II. 4. I.I; IV, 59; V, 27. For the epigraphical data, see Brugnone 1984; Rizzo 1989.

36 Spinning in the Roman World: from Everyday Craft to Metaphor of Destiny

by Daniela Cottica

Different types of sources attest to spinning in the Roman world, ranging from iconography to epigraphy, from literature to the artefacts found in the archaeological record. Each source provides us with a different perception of the process: for instance, spinning required implements, the study of which helps our understanding of technology. On the other hand, the products obtained, and above all textiles, could serve practical/functional as well as social purposes: therefore textiles could also carry social and cultural messages. Similarly, stages of their production and implements used could also acquire religious, cultural and social significance. This paper analyses these latter aspects, in the attempt to explore the symbolism of spinning in the Roman world. The main aim is to identify how the ancients perceived and conveyed the different meanings attached to this process through time. Following this, the analysis focuses on Roman funerary art and contexts where spinning implements frequently appear among the objects chosen for the self-representation of the deceased as indicators of one or more of the following categories: gender, social identity, social status, rank and role of the deceased in society.

Spinning between Craft and Symbolism

The importance of textile production and trade in Roman economy has often been discussed in scientific literature, while recent archaeological research has focused on the study of modes of production and organization of manufacture.[1] Textile manufacture

also played a significant role in Roman everyday life: in literary sources,[2] spinning was so frequently associated with women's domestic tasks that wool-working became a well-known literary *topos*, elaborated within Roman aristocracy, to represent the virtue of the ideal Roman *matrona*, as in the case of Lucretia.[3] This stereotype was widely spread in funerary inscriptions and *elogia*,[4] where the honest, honorable and virtuous woman is often qualified by attributes such as *domiseda* (housekeeper), *lanifica* (wool-working) and *univira* (married to a single man),[5] or by the standard formula '*lanam fecit*'.[6]

Patterns of occurrence of spinning tools in the archaeological record confirm the importance of spinning as a widespread activity, focused on household consumption.[7] Nevertheless, Roman art rarely represents the actual process of spinning itself: a relief in the Forum of Nerva in Rome, still *in situ*, and a mosaic from Tabarka (Tunisia)[8] are among the very few examples known.

Funerary contexts are of crucial interest for the purposes of this present paper. Funerary art and rituals were the final result of complex variables, acting at conscious and unconscious levels in ancient society: the symbolic value attached to certain objects was usually the product of a long-standing process of stratification through time.[9] In Roman funerary contexts the expression *lanam fecit* may occur explicitly in the form of an inscription carrying the message (see above) or implicitly:

a) Through the representation of spinning tools (i.e., spindle/*fusus*, distaff/*colum* and the wool-basket or *quasillum*/*calathus*)[10] on funerary monuments (Figs. 36.1–2);
b) Including one or more spinning tools among the objects chosen to accompany the deceased in her afterlife. Sometimes these objects are very much elaborated, revealing the social status and wealth of the deceased.[11]

Fig. 36.1: Tombstone from Kyzicos with spindle and distaff in a wool-basket, 2nd century AD (Pfuhl & Möbius 1979, Taf. 322, No. 2279).

Therefore, in funerary contexts spinning tools could symbolize social identity (inserting the deceased within *mundus muliebris* traditional values)[12] and/or social display and rank.[13] If, as it seems, a single object could carry several levels of meaning depending on its context,[14] we should briefly analyze[15] the various elements that contributed to the formation of such stratification in the symbolism of spinning.

Spinning and Stratification of its Symbolism in Classical Society and Art

The formula *lanam fecit* testifies to the persistence and wide diffusion of the image of ideal woman, developed in the early days of Rome. In turn, in its process of formation, the Roman feminine ideal type was influenced by Greek[16] and Etruscan culture and art. In this respect Etruscan tradition is well exemplified by the so-called *tintinnabulum* from Bologna and by the wooden throne from Verrucchio.[17] Both objects bear a spinning scene, which, as convincingly demonstrated by Torelli, carries a strong political, ideological and social symbolism.[18] In Etruscan iconography spinning is associated with high-rank, aristocratic women and represents a clear reference to their *role* within the domestic context and society, as wives, mothers and, above all, as guarantors of the continuity and survival of the race. Marriage rituals of the early

Roman period testify to the persistence of the symbolic value of spinning tools in Roman society: the *deductio* ceremony required the bride to approach her husband's house carrying a spindle and distaff, being surrounded by three children.[19]

Fig. 36.2: Tombstone from Bursa with spindles, distaffs and wool-baskets in mirror-like disposition; 2nd century AD (Pfuhl & Möbius 1979, Taf. 322, No. 2280).

From an overall analysis of our sources,[20] we may note that in the Roman world spinning, besides being associated to feminine ideal type (or stereotype) and *mundus muliebris*, played an important symbolic role in religion and myth. As far as these are concerned, Rome was strictly dependent on Greek tradition. Here several goddesses are characterized, among other attributes,[21] by spinning tools as in the case of Aphrodite,[22] Athens and Artemis,[23] goddesses traditionally associated with the female capability of giving birth. Moreover, in Greek religion and mythology, the *Moirai*, represented as spinning goddesses (Fig. 36.3), were associated with the concept of destiny and had an influence on the entire life of human beings, as well as on their destiny. Accordingly, the *Moirai* played a significant role in topic moments of life such as birth, marriage and death:[24] at Sparta for example, the *Moirai*, in association with Artemis and Aphrodite, had a part in marriage celebrations.[25] Greek philosophy elaborated on this subject and the goddesses' cosmic connotation was further emphasized: *Lachesis*, *Klotho* and *Atropos* (symbolizing past, present and future, respectively) spin the spindle of 'Necessity', which in turn moves the spheres of the

Universe, and in doing so, they rule upon human destiny.[26] Spinning from biological representation (as in the case of Artemis and Aphrodite) had become a metaphor for destiny.[27] The metaphor was then assimilated by Roman tradition and further elaborated in the motif of the *Parchae* spinning, or writing, human destiny.[28]

Fig. 36.3: Neo-Attic fragmentary relief from Rome, portraying the Moirai (2nd century AD; LIMC, VI, 2, 376, 'Moirai 18').

Fig. 36.4: Representation of Heracles spinning at the court of Omphale from the tablinum of house VIII, 4, 34 Pompei (PPM VIII).

Furthermore, a whole gallery of heroines was associated with spinning, as in the case of Ariadne[29] and the Nereides;[30] to the mythological sphere belongs the episode of Heracles/Ercoles at the court of Omphale, well attested in both Greek and Roman

iconography.[31] In Classical art there are several representations of this myth, two versions of which are of particular interest for the purposes of this present paper:

1) Representations of Omphale and Heracles with roles not exchanged.[32]
2) Representations of Omphale and Heracles with roles exchanged (Fig. 36.4).[33]

In the above contexts, spinning tools clearly symbolize feminine gender, as opposed to the lion skin and club, symbols of masculine strength. In the exchange scene, the exchange of roles is represented as a change of attributes; the objects exchanged between Omphale and Heracles are traditional symbols of feminine and masculine gender.[34] The symbolic value of spinning tools, as indicators of gender, is further emphasized in a funerary relief from Rome,[35] portraying a Roman couple as Omphale and Heracles, without the exchange of roles. The exchange, however, is *symbolically* represented at the bottom of the relief by the spindle and *calathos* carved below Heracles and by the arch and quiver below Omphale. In this private funerary context, the exchange of roles *de facto* is not represented: an exchange of objects/attributes is symbolically portrayed instead.[36] Indeed in Roman art, images were functional to their context and could accordingly acquire a multiplicity of symbolic meanings.

Fig. 36.5: Stele with married couple from Mediolanum (Tocchetti Pollini, 1990, Cat. No. 7).

Spinning Tools in Roman Funerary Art and Rituals

The funerary sphere appears as a privileged space, where the various aspects of the symbolism of spinning could meet and interact with each other and with the context. Spinning implements can be represented on Roman tombstones themselves, or can be part of the deceased funerary equipment. In the first case we may note two different iconographic schemes:[37]

1) The deceased is not portrayed, while the spinning tools are represented on the monument itself, usually along with other objects such as mirrors, combs, cosmetic boxes *(pyxides)* and suchlike (Figs. 36.1, 36.2);
2) The deceased is portrayed holding a spindle and distaff (Figs. 36.6, 36.7), while a *calathos* may lie next to her feet, or be brought to her, usually by a servant.

Spinning representations on tombstones are attested throughout the Roman Empire, although only a few examples are known from the western provinces. From Gaul comes the tombstone of *Censorina*, holding a spindle and distaff (?) and a stele with a female holding a distaff in her left hand. Perhaps even more intriguing is a stele where a male is involved in a scene with basket, spindle and spindle-whorl clearly visible.[38] Two more examples come from *Mediolanum* (Fig. 36.5)[39] and Mainz.[40]

Rather different is the picture given by funerary art in the eastern provinces, where distaff, spindle and *calathos* are firmly attested on numerous tombstones in Anatolia (from the late Hellenistic period to the 3rd century AD),[41] the Aegean region[42] and Syria.[43] In Roman art the best-known *corpus* representing the spindle and distaff pair comes from Palmyra, in the province of Syria (Figs. 36.6, 36.7).[44] Numerous tombstones depict the deceased woman with a fashionable hairstyle and clothes that blend together Latin, Greek and Oriental features. She often wears sophisticated jewelry and holds in her hand one or more objects of clear symbolic value: a child, a key, a spindle and a distaff.[45]

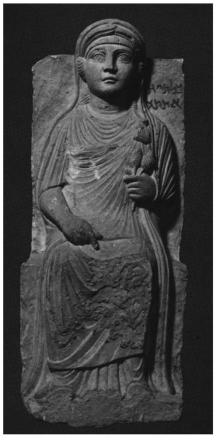


Fig. 36.6: Stele of BLTYHN, wife of Zabda from Palmyra; the deceased is portrayed seated, holding a spindle and distaff (Tanabe 1986, Cat. No. 275).

Fig. 36.7: Funerary bust of G(S)N', daughter of NBWL' from Palmyra, now in the Palmyra Museum. The deceased holds a distaff and spindle (Tanabe 1986, Cat. No. 347).

Palmyrenes were also present on the British frontier: South Shields Roman fort produced the tombstone of Regina (c. 170–180

AD), freedwoman and wife of Barates of Palmyra. Above the text in Latin and Aramaic, Regina appears seated frontally on a chair, within an arched and pedimental niche.[46] A chest and basket (or *calathos*) rest beside her feet. Part of these motifs stems from the art of the Western provinces, but there is a predominant eastern cultural and artistic influence: the Aramaic text, the chest and the basket have close iconographic parallels on Palmyrene funerary reliefs. Above all, the spindle and distaff held together in the left hand across the chest represent a scheme well known in Roman Syria and, more in general, in the Greek, Hellenistic and Roman East, but scarcely ever encountered elsewhere in the Roman Empire. This motif apparently died out in Palmyra between 170–180 AD but survived in the Eastern provinces until the late 3rd century.

So far, archaeological research has uncovered a good number of spinning tools throughout the Roman Empire: finds include tools (spindles, distaffs, spindle whorls) of everyday use (in both domestic and non-domestic contexts) made of various material (bone, wood, metal and occasionally glass), size and form (the latter can be more or less elaborate, according to several factors including function, social status and so forth). The function of some of these tools has been the object of a long-term debate among scholars,[47] as in the case of the distaff of the so-called ring-type.[48] Moreover, not infrequently, decorated spinning tools have been mistaken (especially when fragmentary) for hairpins in archaeological reports and museum records.[49] Even when the objects in question have been rightly connected with spinning, their function has been reason for debate: were they distaffs or spindles?[50] Furthermore, the function of metal hooks found in archaeological excavations has been frequently disputed: could they have been the spindle hooks mentioned in Plato's *Res Publica* (X. 616 c) and depicted in the late 4th century AD mosaic from the *Villa de la Olmeda*, in Pedrosa de la Vega, Spain, depicting Achilles at Sciros?[51] Or were they medical tools, as suggested in the case of similar objects found in a funerary pit at *Aquae Siccae* (Haute Garonne), dating to the end of 1st century AD? Experimental archaeology and ethno-archaeological approach can certainly help us to clarify the issue, avoiding unnecessary speculations.

Of great interest for the purposes of this paper is the occurrence

of spinning implements showing a special concern for the physical aspect of the object itself, bearing evidence of what we may traditionally define as decoration. What is the purpose of the decoration, consisting of fine grooves, collars and globlets, that we can see on some spindles?[52] Was it just functional, or somehow related to gender, social identity and rank?[53] Could a spindle in a 2nd- or 3rd-century grave still echo traditional feminine virtue, the loss of which was already regretted by the time Livy and Columella were writing?[54] Tradition and symbolism are conservative by their own definition, but even in the Near East, by the late 2nd century AD new cultural perspectives were making their way through art, as Palmyrene funerary reliefs demonstrate. The frequent occurrence of *plain* spinning tools in funerary contexts found along the coasts of the Black Sea (dating from the 1st to the 2nd centuries AD) has been associated by some scholars to *Moirai*, *Parchae* and the metaphor of destiny. According to this interpretation, spinning tools may metaphorically represent the link between life and death, symbolizing ‘ … le rôle de la mort dans la famille, la vie intérieure de la maison… ’.[55]

Conclusions

Whereas representations of spinning tools in Roman funerary art remained a regional phenomenon mainly restricted to the eastern provinces, spinning implements are found in funerary contexts throughout the Roman period, up to late Antiquity and throughout the Roman Empire: from Italy to Britain, from Spain to the Balkans, from Egypt to Turkey and the Black Sea.[56] Having briefly reviewed the available evidence, we may conclude that in Roman society the symbolism of spinning tools was the result of a long process of stratification. Among the concepts symbolically associated with spinning and its implements, we may include:

–Gender (as clarified by the mythological scene of the exchange of roles/attributes between Omphale and Heracles).

–Social identity (as testified by epigraphic expressions such as *lanam fecit*).

–Social status and rank (as exemplified by the presence of more or less decorated spinning tools in funerary as well as domestic archaeological records).

–Role in society, through the metaphor of destiny mentioned

above, well attested in Greek and Roman religion, mythology, philosophy and art. 57

This latter point deserves some clarification: when a metaphor is applied to individuals and society, as in the case of funerary art, its semantic value is altered.58 It is certainly not a coincidence that individuals and society are the two poles around which the whole issue of funerary ritual and symbolism is negotiated and defined. In the biological sphere, women play a prominent role, being those who carry and give life. Mythology, as well as art, does not create natural processes but offers symbolic interpretations/representations instead. A human being is conceived by the joining of his/her parents and from here the human fabric is formed; more importantly, a family is created.59 Family is the fabric of society and women play a fundamental role as guarantors of the continuity of the race. In Roman funerary iconography, the broad concept of destiny receives a biological/social connotation in the artistic representation of the role of the deceased in society. This is symbolically represented by adding the spinning implements to the overall composition: these tools already had a long standing tradition as objects linked, in religion and myth, to marriage, giving birth and destiny in general.60

Perhaps, the interpretation suggested above can be better appreciated in those funerary tombstones where the deceased *holds* the distaff and spindle in her hand (Figs. 36.6, 36.7). The portrait of the deceased and accompanying inscriptions already speak for her rank, gender and social status, while the spinning implements seem to add a further element to the representation of the deceased: a reference to her role in family and society. This is a role biologically assigned to her, re-elaborated by mythological and philosophical speculation, reinforced by religion and tradition, associated to the process of spinning, and then transferred to its implements and conveyed to society through art and especially funerary art and rituals.

Abbreviations

La 'Signora del sarcofago' 2001 = *La 'Signora del sarcofago'. Una sepoltura di rango all'interno della necropoli nei cortili dell'Università Cattolica. Proposta per l'allestimento della mostra*, Milan.

MAMA = *Monumenta Asiae Minoris Antiqua,* Manchester.

PPM = *Pompei Pitture e Mosaici*, Rome.

Notes

I would like to thank some of the colleagues who kindly discussed with me the broad subject of this paper. My gratitude especially goes to E. Rova (University of Venice), for the information she shared with me on Sumerian, pre-Hittite and Hittite documentary sources and iconography. I also wish to thank A. Camerotto (University of Venice) for his valuable advice on Greek literary sources, and A. Zaccaria Ruggiu (University of Venice), who first got me interested in the topic of wool-making in the Roman world.

1 The study of textile manufacture and of stages of production has been approached in many different ways and a large bibliography is now available on the subject. Among the most comprehensive works: Wild 1970; 1976; Larsson Lovén & Strömberg 1998; Cardon & Feugére 2000; *The Roman Textile Industry*. For a cross-cultural and interdisciplinary approach to the study of textiles: Barber 1991; 1994. On archaeological evidence for textile production, especially in Pompei: Moeller 1976; Borgart & Puybaret 2003.

2 Such as Svetonius (*Aug*. 73); Livius (I. 57); Catullus (*Epith*. 64. 303–381); Columella (12.3.6); Ovidius (*Met*. 6.55); Martialis (4.19.1); Tibullus (*Eleg*.1.3.83–89). For textile production in Roman documentary sources, see Wild 2000.

3 On this topic, see Larsson Lovén 1998a and her contribution in this present volume. For Lucretia, see Livius I. 57. 9.

4 For example, *Hic est sita Amymone Marci, optima et pulcherrima, / lanifica pia pudica frui casta domiseda* (*CIL* VI. 11602).

5 On these attributes, see Cenerini 2002, 11–28; Torelli 1997, 52–86.

6 For example, *Hic est sepulcrum hau pulchrum pulchrai feminae. […] Domum servavit, lanam fecit*' (*CIL* I. 1007; VI, 15346).

7 Of particular significance is the presence of spinning tools in

domestic contexts such as in the town houses in Ephesus (cf. E. Trinkl's contribution in this present volume) and in Pompeii (Gallo 1994, Nos. 114–119).

8 Here a spinning woman is portrayed, in a typical African rural setting; for the mosaic from Tabarka, dating to the early 5th century AD, see Dunbabin 1978, 12, Pl. XLIV. Spinning is well attested in Greek painted vases: among many other examples, the Amasis' vase (c. 6th century BC) and its interpretation are of great interest: Breniquet & Mintsi 2000.

9 A valuable synthesis on self-representation in Roman funerary art can be found in Zanker 2002, 133–156. For a cross-cultural approach to the study of symbolism of spinning in the ancient world (Classical and pre-Classical), see Cottica & Rova 2006.

10 On the symbolism of the *calathos* in funerary reliefs, to qualify the deceased as wife and/or mother, see Cavalier 1996.

11 As in the case of the ring-type distaff from grave 156 at Zurzach (König 1987, Fig. 114 a). On this issue, see E. Trinkl in this present volume.

12 For instance, this is the case for many funerary inscriptions on unpretentious funerary monuments bearing the formula *lanam fecit*. Here we have a clear example of self-representation and social promotion, so typical of Roman society and funerary art: Zanker 2002, 133–156.

13 As in the case of the ornamented distaff from a sarcophagus in Milan (*La Signora del sarcofago* 2001, 8–9). Another symbol of status and social display is represented by the ring-type distaff from the tomb of *Antestia Marciana* at Aquileia (Brusin 1937, 191–192, Fig. I). For further examples, see Cottica 2003, 265–271.

14 On the methodological issue of interpreting Roman art and 'reading Roman art as the Romans did' (quoting Hijmans), see Zanker 1997 and Hijmans 2000.

15 This theme is extensively analyzed in Cottica & Rova 2006.

16 For a detailed account of woman in Greek funerary epigrams, see Vérilhac 1985.

17 The theme as well as the two objects mentioned in the text, have been analyzed in great detail by Torelli 1997, 52–86; for a rather different interpretation of the Verrucchio throne, see Nielsen 1998. See also Gleba, this volume.

18 Torelli 1997, 52–86.

19 Once again, this aspect of the symbolism of spinning has been analyzed in great detail in Torelli 1984, especially chapter IV.

20 These, of course, include material culture and iconography.

21 Weiss 1992.

22 Suhr 1963, esp. Pl. 13, Fig. 1.; Barber 1994, Fig. 10.1.

23 Cavalier 1996.

24 An overview on the iconography of *Moirai* and *Parchae* can be found in De Angeli 1992.

25 De Angeli 1992, 637 with further bibliographical references.

26 Plato, *Pol.* 617c.

27 On this metaphor see, among many others, Magris 1984, 41–55; this work also analyzes the contribution of Minoan, Mycenaean, Persian and Oriental culture. Significantly the metaphor was already present, *in nuance*, in Hittite mythology as proved by Rova: Cottica & Rova forthcoming.

28 De Angeli 1992, 638, with further bibliographical references.

29 Gullberg & Åström 1970.

30 Cavalier 1996, 40–41.

31 On the iconography of Omphale with Heracles, see Boardman 1994; Caprino 1963, both with full bibliographical references. For

recent studies, Zanker 2002, 198–211; Coralini 2001; 2002.

32 Several examples are known in Classical art: a Lucanian *pelike* at the Louvre Museum dating to the late 4th century BC represents a young, naked Heracles leaning on his club while talking to Omphale, who is wearing a headcloth and crown, holding a distaff and spindle: Boardman 1994, Fig. 4.

33 These are documented in Roman iconography, as exemplified, for instance, by a marble group from the Naples National Museum, dating to the 1st century BC with Heracles represented holding a spindle in his lowered right hand, while a basket (*calathos*) is at his feet: Boardman 1994, Fig. 23. An ivory relief from *Aquincum* shows a naked Omphale wearing the lionskin and holding the club upright in her left hand. Heracles is in woman's dress and cap, holding a small basket in his left hand: Boardman 1994, Fig. 42. Even more interesting, and perhaps less known, is a drawing by La Volpe, reproducing a now lost painting from a house in Pompeii: in the exchange version Heracles wears a very light dress, with a cap or headcloth, and is shown with spindle and distaff, a basket (*calathus* or *quasillus/ quasillum*) rests at Omphale's feet. For this painting, in the so-called IV Pompeian style, see Fig. 36.4 in the text. The exchange of roles is similarly represented on a late 2nd /early 3rd-century mosaic from the Roman villa at Liria-La Bombilla (Spain), see Lippold 1922, Pl.1.

34 In Columella (XII, 3) we read: … *tum iam seorsum arma ac tela separabantur et in altera parte, quibus ad lanificia utuntur*… (…then they separated on the one side weapons and javelins, on the other side implements used in wool-working…). According to classical tradition, spinning, weaving and wool-working in general were among the tasks typically performed by women in the house, as literature clearly testifies. See Torelli 1997, 52–86 (for the Etruscan and Roman world); Vérilhac 1985 and Cavalier 1996 (for Greek society). Cavalier (1996) proved that the *calathos* on funerary reliefs acted as a symbol to qualify a woman as wife and/or mother. For the Roman world, see Cenerini 2002, 11–28 (especially on the expression *lanam fecit* on funerary epitaphs); Larsson Lovén 1998a; 1998b.

35 Cf. Zanker 2002, Fig. 161. The relief is now in the Naples

Museum.

36 Rova has demonstrated that the association between spinning tools and feminine gender is already attested in some Sumerian and Hittite rituals. In the latter, we may find the antecedents of the 'exchange of roles' attested in the Classical iconography and mythology: Cottica & Rova 2006, 304–306.

37 Iconographic sources are particularly abundant in the East. Representative examples of the output of Anatolian artistic funerary production (from the late Hellenistic period to the 3rd century AD) can be found in Pfuhl & Möbius 1979 (See Nos. 548, 637, 638, 793, 924, 931, 1138, 1142, 1154, 1155, 1159, 1636, 1709, 1712, etc.); *MAMA* X, 1993 (See Nos. 2, 10, 45, 48, 59, 83, 101, 104, 134, 141, 143, 160, 181, etc.); *MAMA* IX, 1988 (See Nos. 110, 313, 320, etc.); *MAMA* VIII, 1962, (See Nos. 63, 166); *MAMA* VI, 1939 (See Nos. 277, 287, 311, 325, 363, 368, etc.). For Byzantium, see Firatli 1964. For the Aegean region between the 2nd and 1st centuries BC: Couilloud 1974a (Nos. 131, 154, 160, 469, etc. All monuments usually bear a representation of a *calathos*). For the Hellenistic to Imperial periods: Couilloud 1974b, 397–498 (esp. Nos. 6 and 11).

38 For all of the above-mentioned examples, see Cottica 2003, ns. 19 and 28.

39 Tocchetti Pollini 1990, Cat. No. 7.

40 Hope 2001, Pl. 20 = *CIL* XIII 7067.

41 Pfuhl & Möbius 1979, Nos. 548, 637, 638, 793, 924, 931, 1138, 1142, 1154, 1155, 1159, 1636, 1709, 1712, etc.

42 For evidence dating to the 2nd and 1st centuries BC, see Couilloud 1974a, Nos. 131, 154, 160, 469, etc.; 1974b (Nos. 6 and 11).

43 Parlasca 1981, Taf. 117 No. 4, Taf. 10 Nos. 1–2, Taf. 12 Nos. 1–2, Taf. 18 n. 1 and 3.

44 For various examples, see Ingholt 1928 and Tanabe 1986.

45 The female relief busts from Palmyra portray a gallery of

fashionable Palmyrene women. An austerity of dress and ornament characterizes representations dating from about 50 AD to 150 AD. Here women often carry in their left hand a spindle and a distaff, usually interpreted as symbols of their domestic tasks, and an obvious allusion to their earthly status as housewives; sometimes a little child or a key is shown instead. Reliefs dating from 150 AD to 200 AD display an increasing interest for naturalism and a significant multiplication of necklaces and ornaments. The spindle and distaff gradually disappear; both the child and key appear rarely. In 3rd-century reliefs, the child occasionally nestles in the deceased's bent left arm, but the other objects, including the spinning tools, have vanished. The artists concentrated almost exclusively on drapery arrangements and the like, new symbols of social status and wealth.

46 See Croom 2000, Figs. 22–23.

47 For an overall update on this debate, see Cottica 2003, 265–271.

48 On this type and related debate, see the contribution by E. Trinkl in this volume. For a summary of the *status quaestionis,* Cottica 2003, 269–271.

49 The topic has been widely debated in Cottica 2003, 269–271, with new evidence from the Roman site of *Altinum*, near Venice.

50 Examples from Aquileia and Lyon have been discussed in Cottica 2003.

51 Dunbabin 1999, 157.

52 Numerous examples are gathered in Cottica 2003, 265–271.

53 On ornamental spinning tools as symbol of social status, see E. Trinkl in this volume.

54 Columella expressed his own concern for this loss of traditional values with these words: *Nunc vero, cum pleraeque sic luxu et inertia diffluant, ut ne lanificii quidem curam suscipere dignentur, sed domi confectae vestes fastidio sint, perversaque cupidine maxime placeant, quae grandi pecunia et paene totis censibus redimuntur…* Columella,

12. 9.

55 Pinelli & Wasowicz 1986, 181.

56 For an overview on geographical distribution of finds, see Cottica 2003, 265–271.

57 I.e., *Moirai* and *Parchae*.

58 For a broad introduction to the use of metaphor in social sciences and the concept of metaphor in the study of material culture, Tillery 1999, especially part I.

59 Magris 1984, 50–52.

60 See the observations reported above on marriage rituals at Sparta and Rome.

37 Wool Work as a Gender Symbol in Ancient Rome. Roman Textiles and Ancient Sources

by Lena Larsson Lovén

This contribution discusses wool–the major Roman textile fiber–and wool-related work as a gender symbol. The discussion is based on written and visual evidence reflecting the close connection between wool and female work which furthermore symbolised female virtue and good moral standards.

Roman textiles may in some ways seem illusory to us, due to their usually poor state of preservation. Because of this situation, the study of Roman textiles, and ancient textiles in general, is commonly dependent on additional information in sources other than the textiles themselves. Archaeological textiles, usually a delicate and perishable type of evidence, are, with few exceptions, scarce in most parts of the Roman Empire.[1] However, being basic in human life, the production and use of textiles must have been one of the most extensive roles of materials in Roman society–a fact that is likely to be true all over the Roman Empire. Thus, Roman textiles are not adequately reflected in the current quantity and quality of archaeological finds. But knowledge about textiles based on archaeological evidence is not restricted to specimens found in the ground. Supplementary information can be obtained from other kinds of archaeological material such as workshops, implements used at different stages of textile production, textile patterns on

non-textile objects, non-textile details obtained from textiles, etc.

Fortunately, other source genres supplement these studies with diverse aspects of textiles and their production. Roman literature can add information on textiles: when archaeological finds are combined with information from written sources, the picture we get is sometimes completed. For example, written sources help to illuminate the terminology of techniques, especially for the Early Empire in Italy,[2] and the names of garments and textile products.[3] Analogous sources are the visual arts, which can be used to cast light on how, for instance, Roman clothing looked. Also inscriptions, notably funerary ones, may reveal more. The latter give examples of various issues associated with textile production, such as that of job titles related to Roman textile manufacture, and they occur in the epigraphic evidence from the 3rd century BC.[4]

From the sources it is clear that wool held an important position in ancient Rome, as the primary textile fiber.[5] The use of wool had traditions from Archaic Rome, and wool may be considered 'the original' textile material of the Romans. Wool was not only the most common textile material–it also held a multitude of symbolic connotations, which to some extent are also reflected in the source material. The present contribution aims at discussing some aspects of symbolism, in connection to wool and wool work in ancient Rome, and in particular wool work as a gender symbol. In the following treatment, a combination of written sources will be supplemented with some visual evidence.

Cloth production in early Rome was by tradition supposed to take place in the domestic sphere, and considered to be a female area of responsibility. Associations with wool and wool work accompanied Roman girls and women throughout their lives, often on important occasions. Wool work was part of the young girl's education, and her preparation for the future role and duties of a housewife. Therefore, symbolic connotations related to wool and wool work tend to be particularly attached to Roman women and their work.[6]

The Symbolic Role of Wool in Roman Wedding Ceremonies

The most important rite of passage for a Roman female was marriage, which changed her status from girl to woman. For many girls this event took place in their early or middle teens.[7] The

ceremonies surrounding a Roman wedding comprised several symbolic acts, such as the omission of the girl's childhood clothes and the preparations for the wedding. The wedding ceremonies also included acts where wool and wool work played a prominent part.

The Roman bridal wedding costume consisted of a white woolen dress, *tunica recta*, and a hair-net, *reticulum*, both of which were supposed to have been woven by the bride herself.[8] The *tunica recta* was held together by a woolen belt, *cingulum*, to be made from the fleece of a ewe, and twisted into a cord which was tied in a knot, the so-called *Herculaneus*. Untying the knot was considered difficult and could be done only by the husband, at the marriage bed.[9] Also, the bride's hair was arranged in a particular way on the wedding day. The traditional bridal coiffure was arranged by fastening white woolen fillets, *vittae*, which had a protective function on the day of the wedding and symbolized the bride's chastity.[10] The coiffure was crowned with a garland and a flame-colored veil, *flammeum*. Veiling the bride was a way of protecting her, as were the colors of the bridal dress–white and yellow-red –both of which were considered to be protective.[11]

The bride was expected to have woven her bridal outfit on the old-fashioned upright loom, *tela stans*, as part of the preparations for the wedding. The weaving of the bridal woolen tunic and the hair-net by the bride herself was a symbol of her ability to weave for her husband, and it also symbolized her new position as a housewife responsible for the clothes and textiles in the family.[12] The bridal dress was the symbolic proof that she had learned to master her new role as the female head of the family,[13] and textile production was the wife's major contribution to the economy of the household.[14] This essential, wifely task was further emphasized in the wedding ceremony by the occurrence of a distaff and a spindle in the marriage procession. The implements were carried by the bride herself, or by an attendant.[15] When the procession arrived at the bride's new home, which was normally the house of the groom, the entrance could be adorned with woolen fillets.[16]

According to Roman traditions, the origins of the *tunica recta* used in the Roman wedding ceremony were traced back to the period of the Kings in Archaic Rome, when the first such tunic had been woven by Tanaquil, wife of King Tarquinius Pricus, in the 7th century BC.[17] Even the tradition of decorating the house with

woolen fillets was supposed to have arisen from the legends surrounding Tanaquil, who was considered to have been the spinner of spinsters, *summa lanifica*. Still in the 1st century BC, Tanaquil appears to have been considered the epitome and a model of a very skillful spinner, since items supposedly belonging to her were kept in sacred places in Rome. In the temple of Sancus, her distaff and spindle were kept, and in the temple of Fortuna was kept a toga supposedly woven by her.[18]

Wool Work as a Symbol of Femininity

Wool work and weaving were, thus, part of the traditional household duties of married Roman women. By tradition female work, including that related to textiles, was primarily to take place in a domestic setting. However, spinning and weaving were to be done not in seclusion but in the most public space of the Roman house, the atrium. This was the traditional location of the loom, and the housewife's work by the loom should likewise be exposed to visitors.[19]

The use of the atrium as a place where wool work went on is illustrated by examples in Roman literature, such as the story of the legendary Lucretia. This was related by Livy in the 1st century BC, but the setting is late sixth-century BC Rome when the city was still governed by a king. Lucretia, a noble lady of the Roman social elite, is sitting in the middle of her house, i.e., the atrium, spinning wool together with her maid-servants. Their work is in full view of any visitor in the house. The story told by Livy was supposed to have occurred in a time when Rome was at war with the nearby city of Ardea. One night during the siege the Roman officers started a discussion on the characters of their wives, which led to a bet on whose wife was the most virtuous. In order to decide on the matter, the men rode back to Rome late at night to find out what the women were doing while the men were away from home. On arriving at the house of Collatinus, they found his wife, Lucretia, sitting in the atrium spinning wool late at night. She seems to have been quite unique in this, since the other wives, including the daughters-in-law of the king, had taken the opportunity, with their husbands away from Rome, to party and drink alcohol–a manly way of enjoyment and a certainly unsuitable behavior for the wife of a Roman gentleman. And Lucretia was unanimously awarded the

prize of ‘most virtuous wife’. The outcome of the prize-winning event was, however, most tragic for Lucretia. On a later occasion, one of the men returned to her house and raped her.[20] The man was the son of the king, Tarquinius Superbus, and he had been attracted and excited by her chaste character. The wool working was the emblem of her virtue and chastity, which he obviously felt challenged to destroy, and Lucretia committed suicide afterwards.[21]

As with the story of Lucretia, Roman literature tends to focus on both men and women in the upper social levels: thus, women associated with wool work in this genre are mostly women of the social elite. But in addition to associations of women and wool work in Roman literature, there are many parallels in other sources which cover a wider social spectrum than the literary sources do. In the epigraphic record, mainly consisting of funerary inscriptions, it was a standard feature to refer to women as being occupied with domestic wool work. This appears to have been a concern of women not only in the social elite but of women from different social strata. In such contexts, women who are referred to as working in wool are characterised either as *lanifica* or by *lanam fecit.* Both of these expressions occur in funerary inscriptions during a period of several centuries, from the Republican period into Imperial times. One well-known example of such an epitaph is from late 2nd-century BC Rome, concerning a woman named Claudia. It is a short inscription where the deceased is described as a married woman who had given birth to two sons, took care of the house, was pleasant to talk to, and worked in wool (*lanam fecit*) .[22] For all its brevity, this epitaph still catches some of the most essential elements in the ideology concerning Roman women, and perhaps to some extent even relating to the lives of women on a larger scale–marriage, child-bearing, family life, morality and domestic wool work.

There are other and similar examples of inscriptions of women from different social classes who are referred to in more or less the same manner as the above-mentioned Claudia, although the information may sometimes be given in a longer and more rhetorical way.[23] But regardless of the length of the inscription, the use of associations to female domestic wool work is always of a kind that presents the woman in a positive light.

Visual evidence is another source which can present information

on the subject of textile work and gender symbolism, and especially funerary art has proved useful for such issues. Costly funerary monuments representing a wider social spectrum than just the social elite became more frequent during the 1st century BC. For many people a decorated funerary monument must have been expensive to obtain and meant a substantial economic investment, and as such, it functioned as a commemorative document and a way of displaying social and economic status. This may be further emphasized in the decoration of the monument, where scenes of work sometimes appear. In the scenes related both to textile work and work in general, there is a distinct difference in the way men and women are represented. Men are seen in a more differentiated manner, especially in relation to a variety of occupations which are often symbolized by some item(s) typical of that job.

Fig. 37.1: Funerary stele of M. Valerius Celerinus and his wife Marica Procula. By her chair is a wool-basket, quasillum. Römisch-Germanisches Museum, Cologne, Germany.

Women are represented in more standardized or stereotyped terms than men.[24] The most frequent iconographic symbols of female work in this context are symbols of spinning (Fig. 37.1). In such images women are usually represented holding spinning implements and/or balls of yarn, rather than actually being

occupied with spinning. These images cannot be taken as clear evidence of women's involvement in textile manufacture since their primary aim appears to be symbolic, and socially they belong to what may be characterized as a 'middle class'. Images of women and wool work can be interpreted at different levels. It cannot be ruled out that some women actually did work in wool, but the images are also to be seen as iconographic representations of traditional female work in general, symbolized by the most traditional sort of women's work: spinning.

But wool work was not only used as a symbol of female textile work and work in general. It was also related to Roman gender ideologies and to the moral standards of particularly women. A woman who claimed to be occupied with wool work represented a virtuous and industrious woman with good moral standards, and thus wool work also becomes a general symbol of femininity and female virtue (e.g., Lucretia). Such images are a visual parallel of the inscriptions where a woman could be characterised as *lanifica*. The symbol of wool work is further related to the ideal concerning women's most important roles in society: as housewives occupied with domestic work, and symbolized by wool work –an ideal which was embraced by the Roman social elite. This is documented in primarily literature and inscriptions, and was also adopted by other social levels and documented by them in inscriptions and funerary art.[25]

It is interesting to note that symbols of wool work always appear in an entirely positive way when connected with women, regardless of what kind of source material they occur in, and that they convey more or less the same message. To the ancient Romans, wool work obviously represented a very engendered issue and on an ideological level it may be seen as representing a polarization of male and female spheres in society. This is an example of how gender issues act as promoters of male and female oppositions. To connect a man to wool spinning would be either a mockery or a disgrace, and for a man it would be equivalent to exhibiting moral weakness or a 'feminine character', something entirely negative and the exact opposite of ideals for a woman.

There was no general taboo on men being associated with wool, since men wore woolen clothes and in the epigraphic record there are several job titles with a clear relation to wool, *lana*, which

belonged to men–for instance *lanarius* and *lanipend(i)us* (Fig. 37.2). Among the epigraphic textile-job titles, at least one of them represents the process of spinning: *quasillaria.* However, this appears only in the feminine.[26] It is significant in view of the fact that the people who have documented textile-job titles in their epitaphs are mostly of low social standing, both men and women, such as slaves and ex-slaves.[27] Thus, even here, in another social context than that which caught the interest of the Roman authors, it was impossible for a Roman man to be associated with spinning wool in any context at all.

Fig. 37.2: Funerary altar of a lanipendius. Museo Communale, Rome, Italy.

Thus, apparently it was the stage of spinning the wool that was so essentially feminine that it became impossible for a man at any social level to be associated with wool work and in particular, spinning, since it so distinctly represented femininity–and the opposite of manliness.

Roman State Ideology and the Value of Wool Work

Symbolic wool work was not restricted only to the private lives of the Romans. Wool-and textile-related symbols were sometimes also used in the official state propaganda. Particularly in times of political crisis and social instability, it can be important to emphasize ancient customs and institutions, including traditional

male and female roles, and usually with the intention of demonstrating social stability and order. The best-known example of a situation of political instability where symbolic wool work was part of Roman state ideology, aimed at promoting the restoration of political stability and traditional moral values, occurred during the earlier and middle years of the reign of Augustus (30 BC–14 AD). One vital part of the package of moral restoration launched by Augustus was an attempt to restore traditional moral values: this was aimed at men and women alike, especially in the upper social levels. The expectation for both men and women was marriage, and for married women it was giving birth to legitimate children and devoting their time to the home, family and domestic wool work. One may refer to Claudia in the inscription mentioned above, who was described as possessing these characteristics roughly some hundred years before the time of Augustus.

The moral qualities of both men and women could be further underlined in a visual way by the wearing of traditional Roman clothing. For men, the toga symbolized many things and among them was citizenship and *Romanitas*, the Roman identity. For women in citizen families the traditional costume consisted of a floor-length woolen garment, *stola,* and a mantle, *palla,* likewise made of wool. In the Augustan period, this traditional female outfit was a way of officially accentuating traditional values, political correctness and proper attitudes. Women of the Imperial family, who appeared in traditional dress in public, officially supported the ideology.[28] Traditional dress worked, thus, as a symbol for both men and women although it may have been even more significant for women since the official ideology linked peace and social stability more closely to the conduct of women.[29]

Female wool work played a prominent part in the Augustan 'moral restoration'. By this time it appears to have been standard to buy ready-made clothes. Although the ways of producing textile in the Augustan period were different from the situation in Archaic Rome, the idea of women performing domestic wool work persisted as a symbol of a virtuous female responsible for the household, and representing traditional values. According to Suetonius, Augustus himself wore homemade clothes and, as in the days of early Rome, they were said to have been made by the women of his household, such as his wife Livia. According to tradition, the skills of spinning

and weaving had been taught to the females of the Imperial household as part of their education and upbringing so that, at least in theory, they would know how to do the work.[30]

There are no official monuments from the time of Augustus that illustrate any aspect of wool-working women, so prominent in the Imperial ideology. But, as mentioned above, the message occurs in a number of both funerary inscriptions and funerary art on monuments of civilians, and at a time when most Romans appear to have bought manufactured clothes.[31] However, later in the 1st century AD, there is a state monument where the ideology surrounding wool-working women can be seen. This is in the temple of Minerva in *Forum Transitorium* in Rome. Minerva was the goddess who protected handicraft and especially female work. This motif appears in the frieze of the temple raised by Emperor Domitian and the frieze depicts the myth of Arachne–a very talented female weaver who challenged the goddess in a weaving contest. Supervised by Minerva, spinning and weaving women flank the mythological scenes of the frieze (Fig. 37.3).[32]

Fig. 37.3: Part of the frieze from Forum Transitorium in Rome with women spinning and weaving.

This motif is a unique example in Roman state art, but it is not likely to be a coincidence that it appeared in the reign of Domitian (81–96 AD). His protective goddess was Minerva and, as emperor, he was anxious to identify himself with the social and cultural policy of the first Roman Emperor, Augustus. The decoration of the Minerva temple is to be seen in this light, as a tribute to social stability and traditional values through the virtuous, wool-working,

Roman women.

Summary

It is evident from different kinds of sources that wool held a special position among the textile fibers used by the Romans and that this material was also loaded with symbolic meaning. The symbolism of wool and wool work is associated in particular with women and wool-related symbols accompanied Roman women in different phases of their lives. As discussed above, the symbols related to wool were recurrent in traditional Roman wedding ceremonies, the most important rite of passage for the majority of women, and in this context they were primarily related to the bride and her future task as housewife.

This was one of the most essential tasks for the Roman housewife, both literally and symbolically. According to ancient traditions the housewife was the one responsible for the clothing and the textiles of the household/ family, and wool work stands as a symbol for female work in general. On an ideological level, wool work represents more than just work –it is also a symbol of chastity, female virtue and good moral standards. There are many examples in diverse sources of how women occupied with wool work had a firm standing as models of a virtuous woman, and some of them have been discussed above. In Roman literature, the spinning Lucretia is the paragon of female virtue and it is significant that this story comes from the Augustan period.[33] The story of Lucretia is certainly not about spinning, but the spinning of the wool, which occupied her even late at night, is an essential element in demonstrating her industriousness and her pure character. The same associations are to be evoked by epitaphs where women are described as *lanifica* or by *lanam fecit*, and by images in funerary art where women are presented with implements of spinning.

The symbolism related to wool work does not rule out the possibility that many women actually were occupied with wool work as part of their domestic work. The subject has led to various conclusions, ranging from the view that wool-working women were a mere ideal or a cliché and that at least upper-class women did not do wool work at all, to the opposite view, that even upper-class women did go on practicing their skills.[34] Yet, for some women it

was certainly more than an ideal. For those, usually slaves or ex-slaves, females who have documented spinning and weaving in their, often humble, funerary epitaphs, it was not likely to have been a mere cliché.

Regardless of the source genre, wool work conveys the idea of traditional female textile work, of female virtue and good moral standing, and femininity. It is one of the most distinct, engendered symbols in ancient Rome and it held this position persistently for a long time. Wool work also provides clear evidence of how gender issues work as the exact opposites for men and women: wool work was entirely negative for men, but completely positive for women.

Notes

1 One exception to this is Roman Egypt, where a large number of textiles from the Roman period have been found. For some recent research of textile finds from Roman Egypt, see Bender Jørgensen & Mannering 2001; Cardon 2001; Pritchard & Verhecken-Lammens 2001; Adams and Bender Jørgensen, this volume

2 See Wild 2000 on the problems of interpreting information on such issues.

3 See Pothoff 1992.

4 On job titles in inscriptions and chronology, see Mrozek 1987/88, and Hughes and Cottica, this volume.

5 For other textile materials used by the Romans, see Wild 1970.

6 This situation is not unique for the Romans since women's work and textiles have been intimately connected in many societies/cultures since prehistoric times: see Barber 1994 *passim*. For an example of women's involvement in textile production in the Late Bronze Age, see Nosch 2003 (and bibliography) discussing women's work documented in the Linear B tablets.

7 For a discussion of the age of marriage, see Treggiari 1991, 39–43. During the reign of Augustus a set of laws concerning marriage, divorce, etc., was enacted. In the *Lex Julia de maritandis ordinibus* of 18 BC, the minimum age of marriage for girls was at the age of 12,

and for boys, 14. For more details of Roman marriage law, see Treggiari 1991, 60–80.

8 The *tunica recta* was also worn by the groom, but over the tunic he put on a toga as his ceremonial dress: La Follette 1994, 55.

9 Sebesta 1994b, 48.

10 Cf. the bridal coiffure with that of the Vestal Virgins: see La Follette 1994, 57, Fig. 3.1.

11 Treggiari 1991, 163; Sebesta 1994b, 48. All details of the Roman bridal dress had a symbolic meaning and to quote La Follette (1999) on the bridal dress '... through her costume and hairstyle, the bride became noble, sacred, chaste, and fertile with all the power of each attribute': p. 61.

12 La Follette 1994, 54f.

13 Sebesta 1998, 110.

14 Treggiari 1991, 243.

15 Varro, *Lingua latina* 5.61; Treggiari 1991, 166.

16 Pliny, *Nat. Hist.* 28.142, 29.30; Treggiari 1991, 168.

17 The traditional dating of the reign of Tarquinius Priscus is 616–578 BC.

18 Pliny, *Nat. Hist.* 8.194; Fayer 1986 3f.; La Follette 1994, 54f.

19 For a discussion of the Roman house as an engendered space with the atrium as a space of prestige and symbolic value, see Wallace Hadrill 1996.

20 Livy, *Ab urbe condita* 1.57.4–5. According to Livy, the day after the rape, Lucretia summoned her father and husband to tell them what had happened before she took her life by stabbing herself. The male relatives of Lucretia decided to avenge her death and this led to an uprising and the overthrow of the Roman monarchy. The result was the introduction of the Roman Republic, traditionally

dated from 509 BC.

21 For a more detailed discussion on the subject, see Arieti 2002.

22 *CIL* 1.1211 (=6.15346).

23 See for example the inscriptions of two upper-class women, Turia (*CIL* 6.1527) and Murdia *(CIL* 6.10230).

24 For a more detailed discussion on representations in general of work and occupations in Roman funerary art, see Zimmer 1982. For scenes related to textile work, see Larsson Lovén 2002.

25 This ideal was apparently not restricted to Italy, since similar representations occur in the Roman provinces, too. Representations of women and symbols of wool work were quite common also in the funerary art in Roman Gaul, see Larsson Lovén 2002.

26 *CIL* 6.6339–6345, 6.9496, 6.9849–9850. The examples of *quasillariae* published in the *CIL* are altogether very few, and so far all of them come from the city of Rome. For female job titles in general in the epigraphic record, see Treggiari 1976.

27 This situation is not unique among the textile-job titles: over-representation of slaves and freedmen is a general trend in funerary inscriptions including job titles, see Joshel 1992 *passim*. For a discussion on methodological issues concerning job titles in general and textile ones in particular, see Dixon 2001.

28 See Zanker 1988, 15; Sebesta 1998.

29 d'Ambra 1993 89f; Sebesta 1994b, 107. It was not a new view in Augustan times to link women's conduct to the well being of the state. A similar ideology linking female conduct and the general situation in society embraced the Vestal Virgins who in times of crisis for the Roman state could be accused of loose morals, see Pomeroy 1975.

30 Suetonius, *Augustus* 74.

31 This does not appear to have been a recent phenomenon at the time of Augustus since already Cato the Elder in the second century

BC advised wealthy estate owners to buy ready-made clothes for their slaves because they were cheaper than those produced on the estate itself: Cato, *Agr. Orig.* 135.1.

32 See d'Ambra 1993 for further details on the Minerva temple, its decoration and the interpretation of the frieze.

33 In addition to Livy, the story of Lucretia is also related by the Augustan poet Ovid, see Ovid, *Fasti* 2.741–43.

34 Treggiari 1991, 243. The ideal of the industrious housewife may be compared to attitudes toward women in much later times, and has been compared to women's embroidery in the 19th century and knitting in the 20th in order to keep them from being idle. Treggiari mentions the common practice of women in Apennine villages in southern Italy in the 1960's of regularly sitting outside the house knitting.

38 Christian Influences and Symbols of Power in Textiles from Viking Age Denmark. Christian Influence from the Continent

by Anne Hedeager Krag

Hitherto it was thought that fine costumes with gold and silver threads, silk clothes and blue and red textiles were quite unique in the Danish Viking Age. New analyses of very small textile fragments have revealed, however, that costly textiles were far more common in the 10th century than previously thought.[1] *(Fig. 38.1). Examination of these textile fragments from Danish Viking Age graves shows a dress with a European origin and with influences from Christianity. Moreover both these influences have their source in Byzantium. Furthermore fragments with gold and silver threads have regularly been found in carriage-body graves, a burial custom which was reserved especially for women in South Scandinavia in the 10th century. Two additional examples are the Hørning- and Hvilehøj graves, both of which date to the last part of the 10th century,*[2] *where silk textiles and tablet-woven borders with gold and silver threads have been found; these finds indicate contact with continental Europe. Similar evidence of contact is seen in tablet-woven borders with gold and silver threads and silk textiles found in a chamber grave in Bjerringhøj at Mammen. These textiles were found with other costly grave-goods which belonged to a man. The grave has been dated by dendrochronology to 970/971 AD.*[3] *A further example is a man's ship grave in Ladby at Funen, dated 900–950 AD, which contained silver passementerie and gold threads originally from a caftan, which is a piece of a man's dress.*[4]

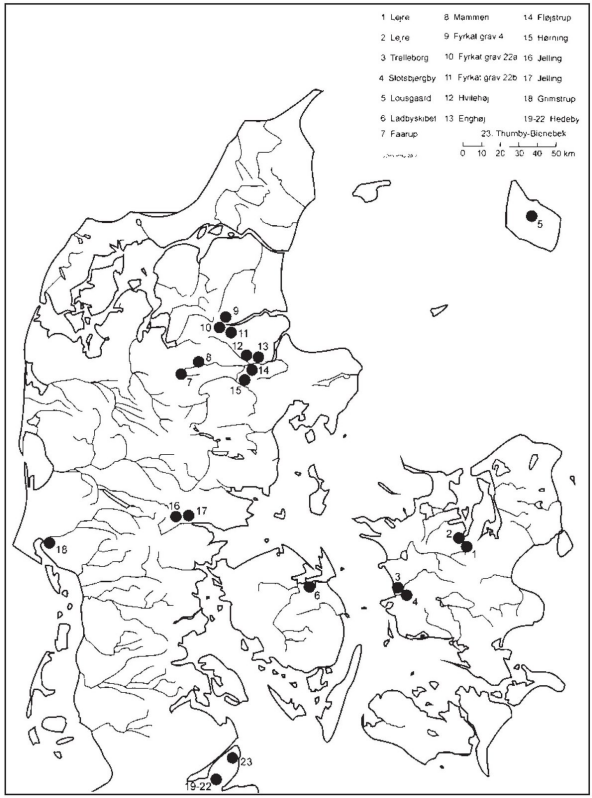
In this paper I will argue for Christian influences and symbols of power in textiles from two of those graves. The first is the grave in Hvilehøj (no. 12 in Fig. 38.1), a woman's grave; the textiles found here show influence from the Continent. The second is the ship-grave in Ladby (no. 6 in Fig. 38.1), in which the man's garment found there shows influence from Eastern Europe.

Hvilehøj was excavated in 1880 as a barrow grave, and is described in a publication from the following year.[5] Ever since publication, Hvilehøj has been one of the most famous Viking-Age burials from Denmark due to its precious, but unfortunately, extremely fragmentary textiles. Hvilehøj is dated to c. 950–975.

The political and ecclesiastical influence of the powerful Christian Ottonian Empire is reflected in the contents of this grave, especially in the form of a small silver coin that had been perforated and used as jewellry. This coin was struck at Cologne during the reign of Otto I (AD 936–973).[6]

In Fig. 38.2 on the top, there is a fragment of a tablet-woven ribbon. On each side of the ribbon there is a patterned textile which the latest analyses indicate is silk.[7] It is of particular interest that the silks from Hvilehøj are decorated. In the grave there are fragments of fine leather material on which are the remains of a tablet-woven band.[8] Perhaps the leather was originally part of a fur, belonging to an overgarment. The fragments of textiles also included a fine, brocaded wool cloth. The patterns form crosses and lozenges whose lines follow both directions of the threads.

Fig. 38.1: Danish Viking Age Grave with silks and passementerie.



These costume designs came to Denmark from the south. In particular, in Viborg and Randers counties in Jutland, grave finds from the 10th century containing textiles that were influenced by the Ottonian Christian area have been recorded.[9]

Iconographic Examples

The small pieces of precious textiles cannot tell us how the noble Norse women were dressed in the Viking Age, but by comparing these with contemporary Norse iconographic examples, it might be suggested how women of high status were dressed in the 10th century.

The tapestry from Nedre Haugen, Rolvsøy in Østfold, Norway, shows a ship and two rows of people, where the two foremost figures are women (Fig. 38.3). They are wearing long dresses or tunics with trains, and capes or veil. In addition, there is a yellow

pattern in the capes and dresses which could be interpreted as gold brocade patterning.[10] The veil and the gold thread embroidery are costume influences that came to Denmark from the Continent. An Ottonian manuscript, made in Mainz, Germany, at the end of the 10th century, shows a woman wearing a red head covering or a veil edged with golden ribbons.[11]

Christian Influence from the East

Examination of passementerie and gold and silver threads from a man's grave, a Viking-ship grave in Ladby, shows influence from the East, with contact from Birka in Sweden and through the Russian rivers to Byzans.[12] The Ladby ship-burial is dated to the period 900–950.[13] The grave was excavated in 1935, and the finds included, among other things, several examples of small buttons produced in silver-thread passementerie in gold and silver thread, as well as gold-thread embroidery[14] (Fig. 38.4). The fragments represent a valuable garment, which is thought to belong to a caftan, a coat-like garment with sleeves. It was fastened in front with passementerie, with a fastening either down the middle of the front or at an angle across the front. The caftan was originally a garment characteristic of Central Asia.[15] Other archaeological sources and iconographic examples reveal that the caftan influenced European noble costume in the Late Iron Age and the Viking Age (from circa 550 to 1050).[16] Among the buttons are two triangular pendants (nos. 316 and 357). These are about 1.75 cm. across, and are formed as equilateral triangles with triangular plates in each corner and a gold plate in the middle. Silver-thread borders are found around the plates. Both examples have a small silver loop at one end. Perhaps they could have been *tintinnabula* or *mala punica*, small bells. In a silk caftan from Birka there was a special ribbon with passementerie and small pendants with plates in the middle. Those pendants are known from the language of Christian symbolism.[17] From Exodus 28, 33 ff, the hems of the priests' garments were bordered with golden bells, *tintinnabula* and pomegranates, *mala punica*. The Byzantine Emperor used those elements in the garment some time in the 10th century, because he wanted to demonstrate his part as a Christian ruler. The costumes from Ladby reflect Byzantine influence, presumably relayed via the royal house of Rus' in Kiev.[18]

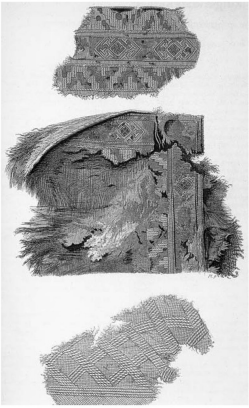


Fig. 38.2: The textiles from Hvilehøj.

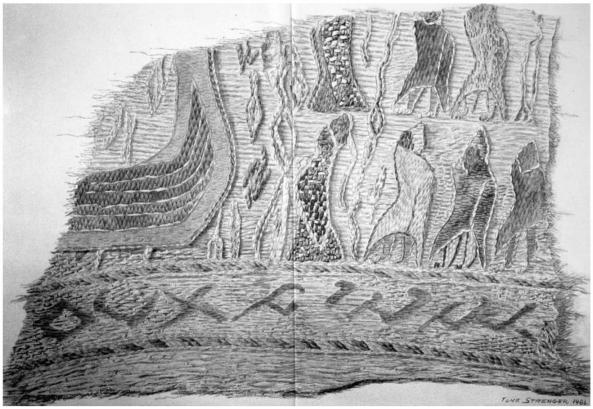
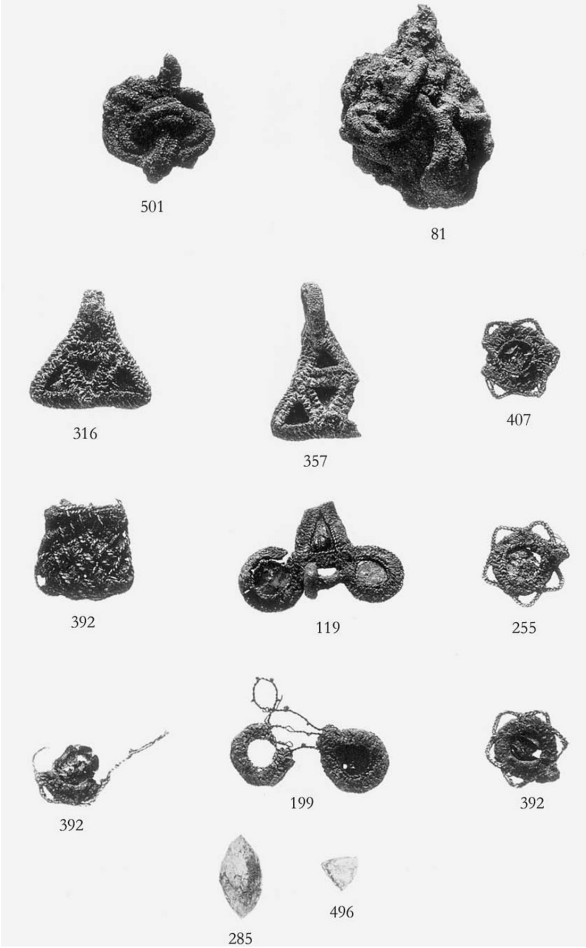


Fig. 38.3: Tapestry from Nedre Haugen, Rolvsøy, Østfold, in Norway.

Fig. 38.4: The passementerie from Ladby.



In the Byzantine Empire in the 10th century, the caftan with silk strips and passementerie was the fashion for the leading class. The Russian rivers could have been the route by which the Byzantine caftan with this type of decoration was transported to the north.[19]

The Arab envoy, Ibn Fadlan, was a member of a delegation that had been dispatched from the caliphate in Baghdad. Ibn Fadlan described in a travelogue how he met Vikings in 922 by the Volga River. He gave a description of the delegation's route, and amongst other things, described in detail a Viking chieftain's funeral in a ship by the Volga River. This is of interest as the only eye-witness account we have to shed light upon this particular area in the

history of the Viking Age, which is often only revealed to us through archaeological evidence. One detail of the description is that the deceased chieftain was dressed in a caftan with silk brocade and gold buttons. Archaeological finds of silk brocade and golden buttons in two chamber graves at Gnezdovo in the Dniepr region of Russia confirm that the Vikings wore a caftan-like garment.[20] These may have been made by the Rus'.[21]

Iconographic Examples

The word 'oriental' is used for Islamic and eastern culture provinces, but Byzantine costumes are also included amongst the oriental. The oriental-inspired caftan is known from the Viking Age primarily through iconographic examples.[22] A caftan-like overgarment is known from mural paintings from the 3rd century AD. In the synagogue of Dura Europos, near the Euphrates in Syria, there are some valuable depictions of Parthian costume, especially on the horsemen and the king. The pictures illustrates the Esther cycles from the Bible (Fig. 38.5).

Literary Evidence of Christian Influence in Dress from the Viking Age

In the year 826, the Danish King Harald Klak and his wife were baptized at the court of the French King Louis the Pious (814–840) in Mainz. The event was described by the contemporary monk Ermoldus Nigellus in the poem *The Baptism of King Harald.*[23] This includes a description of the clothing the Danish King and his wife were presented with after the baptism. Harald's costume consisted of a purple tunic trimmed with gold and gems, a belt and gold-brocaded silk cape. Harald's wife was given a gold-brocade silk costume; she also wore a gold-wrought veil, belt and bracelet. In the Old Scandinavian literature 'Päll' is the word for gold-brocaded silks. The style of the costly clothing was inspired by Byzantium.[24]

The Christianization of Denmark

Harald Klak was the first Scandinavian king to be baptized, but he was driven out of Denmark by the Danes a year later and forced to spend the rest of his life in exile. It is, however, clear that by the

middle of the 9th century some, perhaps many, powerful Danes were prepared to tolerate Christianity. Denmark gradually became Christian during the 10th century, with Christianity being declared as the official state religion in 965 by the Danish King Harald. It was King Harald who built a large church in Jelling and commissioned a monument displaying a huge image of Christ crucified and on which he proclaimed his achievement in 'making the Danes Christian'.[25]

Fig. 38.5: The Persian King and beside him, Esther the Queen.

Conclusion

The Danish graves from the Viking Age with silk fragments with gold and silver threads show close connection with Byzantium. In the 10th century, silk fabrics were manufactured in Byzans. Further information about the silk industry is to be found in the *Book of the Eparch*, a collection of provisions regulating the activity of a number of professional guilds in the Empire's capital.[26] The original text clearly belongs to the early 10th century. Archaeological finds from the Viking Age demonstrate the taste of the North men for foreign silks. Besides these finds with Danish silks, there are c. 60 graves excavated at Birka, the important trading place of central Sweden from about 800–975, which contained silk fabrics.

Furthermore in the rich ship-burial at Oseberg in Norway, dated by dendrochronology to 820 AD, strips of silk were found that had been cut from a larger piece.[27] Thus the Scandinavian textiles show contact with the European Christian areas, both from the Continent and from the East.

Notes

1 Hedeager Krag 1999, 425; 2003, 69.

2 Hedeager Krag & Ræder Knudsen 1999, 159; Hedeager Krag 2003.

3 Andersen 1991, 43.

4 Thorvildsen 1957, 78; Sørensen 2001, 73.

5 Engelhardt 1881, 79.

6 Hedeager Krag & Ræder Knudsen 1999, 162.

7 Irene Skals from the Danish National Museum has analyzed the silks and found different types of weaving.

8 Hald 1980, 115, Fig. 113; Munksgaard 1974, 175; Bender Jørgensen 1986, 227.

9 Hedeager Krag 1999, 434.

10 Johansen 1986, 147; Hedeager Krag & Ræder Knudsen 1999, 170.

11 Görick 1994.

12 Jansson 1989, 594.

13 Sørensen 2001, 57.

14 Thorvildsen 1957, 78. Fig. 69; Sørensen 2001, 76, Fig. 4.15b.

15 The Hermitage Museum in St. Petersburg possesses an impressive collection of at least 16 silk caftans. They were found in

tombs of local tribes at Moscevaja Balka in the Northern Caucasus. Archaeological textile studies have been made by Anna A. Ierusalimskaja of the Hermitage Museum who has dated the textiles between the 8th and 9th centuries AD. Her work indicates that these sites were situated on a trade route, which, after the 6th and 7th centuries, was an extension of the Silk Route (Riboud 1976, 21 ff.; Ierusalimskaja 1996, 45).

16 Watt 2003, 28.

17 Hägg 2003, 14.

18 Jansson 1989, 594.

19 In The Russian Primary Chronicle, the so-called Nestor Chronicle, the contact between Kiev and Byzans is often mentioned (Hellmann 1987, 64).

20 Bæk Simonsen 1981, 56. Avdusin & Puskina 1988, 28 ff.; Shepard 1995, 250.

21 Hägg 1984, 208.

22 The mural paintings from Dura Europos are today at the National Museum in Damascus, Syria: Literature: *Dura Europos Salhieh of Euphrates in photos.* The National Museum of Damascus.

23 Olrik 1886

24 Geijer 1957, 324. There is additional evidence of Byzantine influence at the court of Charlemagne in the 800's, and there can be little doubt that the revival of the imperial tradition in the West by Charlemagne was based on a study of the Byzantine imperial system (Beckwith 1989, 326).

25 Sawyer 1987, 68.

26 Jacoby 2001, 3.

27 Geijer 1938; Jansson 1989, 636.

APPENDIX: FIRST AID FOR THE EXCAVATION OF ARCHAEOLOGICAL TEXTILES

Guidelines for the Excavation of Archaeological Textiles

by Jana Jones, Julie Unruh, Regina Knaller, Irene Skals, Lise Raeder Knudsen, Eva Jordan-Fahrbach, Louise Mumford

Textile finds occur in many different environments under a variety of conditions. Some guidelines are proposed for the following: the excavation process, documentation and storage of excavated material, and collection and storage of samples for scientific analysis. In the absence of an on-site specialist, 'preventive conservation' (provision of optimal conditions to inhibit deterioration and prevent damage) is encouraged.

Introduction

Archaeological textiles are rare finds in some countries and on some sites. Therefore some archaeologists may not recognise them immediately, perhaps are not aware of their importance, and as a result are not always prepared to handle them if they are found. Not only archaeologists, but textile researchers, conservators and chemists deal with various aspects of archaeological textiles. It is of extreme importance that all of these professionals are aware of one another's activities and can enter into dialogue. It is equally important that these experts discuss the various aspects of excavation, preservation and archiving of archaeological textiles

with the organisers when an excavation is being planned, clarifying the costs, needs and responsibilities of all. This can prevent irreversible mistakes and ensure both the preservation and successful outcome of research analysis of the material.

Textile finds benefit from the presence of an on-site textile conservator and specialist. Conservators have knowledge of the chemistry of fibre degradation, can diagnose the state of preservation of textiles, and are trained to handle very fragile objects. They are informed about safe storage materials and have experience in packing objects for transportation. A conservator or textile specialist can identify textile structures that may not be obvious to archaeologists who do not specialise in textiles. Moreover, the quality of conservation treatment is enhanced if the conservator is able to see the object *in situ*. Ideally, a textile conservator or textile specialist should perform the lifting.

However, it is clear that such an ideal situation is not always feasible, especially on sites where textiles may be chance, unexpected finds. The following guidelines for the textile retrieval, documentation, sampling for future analysis, and proper storage procedures may assist excavators working with textile finds.

Excavation

Textiles survive most frequently in conditions of extreme dryness, permafrost, waterlogged conditions, in contact with corroding metal objects, or in carbonised form within burnt layers. At the moment they are first discovered, archaeological textiles are exposed to enormous danger due to a sudden change in their immediate microclimate. For this reason, changes in any type of climatic conditions must be avoided as much as possible during excavation. Unnecessary movement or touching is also to be avoided.

The excavation process will include a number of considerations, including the following:

–*Textiles should always be supported while lifting*, with flat supports that can be slid underneath. These can be strong cardboard or wood covered with aluminium foil to prevent contamination, or thin sheets of rigid plastic such as perspex or heavy-gauge Melinex. Larger textile finds can be stabilised and block lifted using plaster or fibreglass bandages to

surround and reinforce the block.

–*Ideally the whole textile should be lifted with the surrounding matrix*, without changing the position of any fragments. It will be easier to identify features such as folds, seams, buttonholes and other details if the exact position of the textile is maintained. Other vital information may also be present in the surrounding soil (see below).

–*Textiles from extremely dry environments* should be lifted with the surrounding earth where possible. In some cases, the soil or sand supporting a fragile textile may need to be 'consolidated' (impregnated with an adhesive) in order to lift it intact. A consolidant is injected into ***the soil matrix only*** at several points around the specimen, so that it can be lifted as a block. ***The textile itself should not come into contact with the consolidant*** (see below). A conservator should be consulted about consolidants that are currently recommended, and the suitability of a particular soil consolidant to the specific conditions at the site.

–*Frozen textiles* should be lifted within a frozen block and kept frozen until treatment in the laboratory. If necessary, they can be kept deep-frozen *in situ* using carbon dioxide ice. Do not use hot water to 'rescue' frozen textiles.

–*In waterlogged environments*, wet and dirty textiles can be difficult to recognise, so be attentive. Wet textiles should be block-lifted within a sediment block where possible, and kept wet. Small sediment blocks can be carefully placed into plastic boxes with a layer of polyethylene foam such as Ethafoam on the bottom, stabilised against slipping, and kept wet by keeping the foam damp. Larger textile finds can be stabilised using plaster or fibreglass bandages to reinforce the block. Non-PVC polyethylene cling film should be placed around the block before the application of the plaster or fibreglass to facilitate excavation of the block in the lab without damaging the textiles. Seal the closed boxes or sediment blocks inside plastic bags in order to avoid moisture loss, and keep wet until further excavation in the laboratory.

–*Textiles in contact with metal objects* are often firmly attached to the corrosion. Do not attempt to separate textiles and metal objects in the field. Examine the surrounding soil carefully, as soil stains or 'brown shadows' can be evidence for the original

position of the textile, and can contain textile information. Document the relationship of the artefacts, and lift the textile together with the metal object and the surrounding soil.

–*Carbonised textiles* are extremely brittle and will break into innumerable components if touched carelessly. Lift with good support and do not attempt to separate them from the surrounding soil.

–*Textiles may be found on human remains* in both wet and dry environments. Lifting of the textiles depends on the manner of retrieval of the remains. If the whole body is to be block lifted, excavation of the textiles should be carried out in the laboratory. In extremely arid burial environments, human remains are often disarticulated and cannot be lifted whole, necessitating separate retrieval of the textiles. Thorough *in situ* documentation is vital, with detailed drawings and photographs. The skeletal material should always be examined for any textile that may be adhering, and its location recorded for the textile specialist and conservator.

–*Consolidation (impregnation) of textiles* is not recommended unless it is absolutely necessary, as consolidants impair some types of scientific analysis (discussed below). However, some textiles begin to disintegrate on exposure. In such cases it may be necessary to consolidate the textiles immediately *in situ* if the structure is to be saved. If textiles are fragile enough to require consolidation prior to lifting, a conservator would suggest a consolidant that is appropriate for both the site and the textile, and would advise on an appropriate method of application that will not destroy the textile morphology. The consolidant should remain stable and soluble over the long term, and should have a pH that is compatible with the textile. If a textile must be consolidated, one should always first take a sample of the untreated textile for any future scientific analysis, if it is possible to do so without damaging the rest of the specimen.

–*Transportation of textiles to the laboratory*. Care should be taken to prevent fragile specimens from damage in transit by placing in rigid boxes, preferably packed with crumpled acid-free tissue paper to prevent movement if they are dry. The convenience of placing textile samples in plastic bags immediately on excavation needs to be evaluated against the

infusion into the sample of exotic plasticisers.

–*Recording of the textiles* when still *in situ* is vital to future interpretation, with photographs and drawings noting the exact placement of each fragment in plan and section. A copy of this documentation should be kept with the textile, and the original stored safely for future data analysis.

Changes in climate can accelerate deterioration of the textiles, so it is important to maintain the original microclimate in the storage environment. A general rule that always applies is that finds from a dry *milieu* should be stored in dry conditions, finds from wet environments kept wet. Wet textiles are in danger of micro-organism (bacterial and fungal) growth. Micro-organism growth can be minimised by keeping wet textiles refrigerated, by keeping them in an alcohol fume-saturated storage container, or by periodically spraying them with ethanol until treatment by a conservator. The use of biocides is generally no longer recommended. Many biocides are highly toxic and their effectiveness has been questioned. Furthermore, addition of a biocide will prevent future analyses. Any benefits of disinfecting must be weighed against these drawbacks.

Documentation

The importance of quick documentation cannot be overstated. Many archaeological textiles appear to be in good condition when discovered but deteriorate quickly. If there is a time gap between excavation and full documentation, important details may disappear. Fragile archaeological textiles sustain damage every time they are touched; limiting the amount of times necessary to handle them is therefore preventive conservation.

Basic documentation after excavation should include as much as possible of the following. However, it must be stressed that this should be undertaken by persons with expertise in textile analysis, in order to avoid incorrect descriptions which may be perpetuated in published reports. Otherwise, only basic, identifying details should be recorded. Examination is best carried out with a stereomicroscope at a magnification of around 30x with a calibrated linear graticule in the eyepiece, but a hand-held lens and thread counter may be adequate, provided they are not placed directly on the textile. For technical terminology and guidelines to cataloguing,

see C.I.E.T.A. (*Centre International d'Étude des Textiles Anciens*) 1964, 1971 or 1997 and Walton and Eastwood 1988. A brief glossary of terms is provided at the end of this paper.

–*Description* (intact/complete, fragment, clothing, shroud, bag, etc.)
–*Condition of the fibres* (intact, in process of degradation, degraded, carbonised)
–*Dimensions* (maximum length and width of all fragments. If folded or crushed, measure without straightening and record the condition)
–*Present colour* (for both warp and weft yarns)
–*Fibre type, of both warp and weft yarn* ('probably' wool, flax, cotton, etc.) Definitive fibre identification can only be made by microscopic analysis at high magnification.
–*Yarn counts per cm* (in both the warp and weft directions)
–*Spin*, i.e., direction of twist of the yarns (S, Z, or I)
–*Angle of twist of the yarns* (loose, medium, tight)
–*Description of pliedyarns* (number of ply, twist direction of component yarns)
–*Diameter of yarns*
–*Weave technique* (tabby weave, twill, etc.)
–*Faults* (irregularities during production, such as double-laid yarns)
–*Diagnostic features* (starting/finishing edge, selvedge, seam, fringe, repair).

A visual record should be made of each specimen that includes a drawing, if possible, and a photograph, and the storage mounts should be numbered. Tracings can be made using plastic drawing paper over (but not touching!) the textiles, and an indelible pen. Photocopies of the drawings can then be made.

To Clean or not to Clean?

It is essential to assess whether an excavated textile should be cleaned and/or conserved before undergoing technical analysis, and each sample should be evaluated individually according to its condition, and the quantity of material found. Much vital information can be lost by removal of the surrounding matrix. The adherent soil may contain evidence for use of the textile, while soil

chemistry provides information on the environmental factors that may have contributed to its alteration. Moreover, the success of chemical and biochemical tests relies on evidence provided by uncontaminated material. Cleaning and conservation treatments will often distort and negate the results of analyses available to textile researchers.

On-site cleaning other than that carried out by conservators or trained textiles specialists should be discouraged, as untrained workers, though well-intentioned, can destroy critical information. If absolutely necessary in order to facilitate documentation, the only cleaning method recommended on-site for textiles from dry environments is careful brushing with soft sable or camel hair brushes, or dusting off with a camera 'blower brush'. Creased or folded textiles should not be unfolded. Mud-encrusted, wet textiles should be kept damp until treatment. They must not be brushed, or allowed to dry out and then be re-wetted. It should be remembered that fibres are generally weaker when wet, and haphazard cleaning of archaeological textiles can result in a catastrophic loss of structure and information.

Physical, Chemical and Biochemical Analyses

Wherever possible, samples of untreated, uncontaminated material should be put aside for interpretation by textile experts and chemists. Comprehensive data should be made available to the conservator to assist in determining the appropriate treatment if the textile researcher studies the material first.

Some useful analytical methods for textile research include morphological examination by microscopy, chemical analysis by gas chromatography/mass spectrometry (GC/ MS) and infrared microspectroscopy (FTIR) for identification of resins, oils and balsams, as used in funerary wrappings. Elemental analysis using scanning electron microscopy/energy dispersive x-ray spectroscopy (SEM/EDX) gives information on the elements present and their relative quantity in pigments, mordants, and salts, as well as proteins in animal fibre. Radiocarbon dating by accelerator mass spectroscopy (AMS) gives absolute dates for disturbed contexts or textiles without provenience, and DNA sequencing identifies plant and animal fibre where microscopical techniques have failed.

Fibres between 3mm and 5mm in length are sufficient for light and scanning electron microscopy. GC/MS can be successful with only a few milligrams of material. Radiocarbon dating by AMS requires between 3 mg and 10 mg, while pigment analysis by SEM/EDX can be carried out with a quantity of particles equivalent to the size of a pinhead.

Collection of samples for analysis

The textile should be examined with a stereomicroscope before removing fibre samples. Although undamaged areas would provide a more representative sample than damaged areas, for obvious reasons it may not be advisable to remove yarn from intact parts. The area from which the samples have been removed should be documented. Loose fibres or yarns should not be chosen for sampling because they could be intrusive. Carbonised textiles are fragile and warrant special care in taking samples for dating. It is generally impossible to extract whole fibres from them.

Sampling is best carried out under the stereomicroscope, using a mounted needle, straight surgical forceps with an ultra-fine point, and very sharp small scissors, or a scalpel. Yarns should be cut, not pulled. Contamination should be avoided during this process, and samples placed immediately into appropriate containers for storage. When handling textiles, surgical gloves without powder coating should be worn rather than cotton, as the intrusive fibres sometimes give misleading results.

Storage

Storage of samples for analysis

Storage of samples in the right medium for the proposed test is essential. Ideally, samples destined for chemical and elemental analysis should be stored in glass vials with a Teflon-lined lid, first purged with nitrogen. As these are unlikely to be available on the average excavation, the next best option is to wrap them carefully in aluminium foil and then place in paper bags, and store out of

light. Neither plastic nor paper should be used directly on the sample, because the plasticisers in the former will register in the analysis, and the latter can affect results if testing for plant residues.

Samples for radiocarbon analysis should be wrapped in aluminium foil and placed into a well-sealed polythene bag labelled on the outside, and then into a second (or even third) sealed bag. Contamination from any modern carbon must be avoided, so no paper cardboard labels should be placed inside the bags (and no smoking!). Continuing photosynthesis must be avoided: this is achieved by storing the samples in a dark place. DNA analysis requires meticulous collection with sterilized equipment, preferably directly from the textile *in situ*. Masks and surgical gloves must be worn to avoid contamination. Samples must be placed immediately in sterile containers, either glass or plastic, and kept in a cool, dark place.

Fragments of fibre for microscopy can be 'sandwiched' between two glass microscope slides and secured with pressure-sensitive tape. If no chemical or analytical tests are proposed, wrapping in foil or folded 'envelopes' of acid-free tissue paper may be a more practical solution.

Storage of archaeological textiles

Outdated storage techniques have damaged, and continue to damage, archaeological textiles. It is important to periodically reassess old procedures in order to avoid continuing destructive practices. In the past, many excavated textile fragments were simply placed inside plastic bags or piled together in boxes for long-term storage, where they have been prone to degradation and disintegration resulting in the loss of a resource.

The correct environmental conditions for archaeological textile storage will vary with the burial conditions in which the textile was found and the storage history since excavation. It is best to consult a conservator when determining the long-term storage requirements for a particular collection. If necessary, inexpensive microclimates can be easily constructed using airtight containers and silica gel.

On excavation sites where the facilities are limited and the quantities of material are large, dry textiles may be wrapped

individually in acid-free tissue paper, labelled both on the inside and outside, and packed in strong boxes. If they are to be stored in layers in large containers, they will need rigid supports or pedestals between the layers to prevent crushing. The choice of material for the containers will be dictated by the prevailing conditions. In some climates, insects will destroy wooden storage boxes and shelving, and acid-free paper and cardboard boxes. In such cases the use of aluminium foil instead of acid-free paper to wrap the textiles is a deterrent to insects. In other climates, metal storage containers will corrode, contaminating the collection with corrosion products, and metal should be avoided. Plastic storage containers are insect-resistant and non-corrosive. However, care should be taken to package textiles within inert plastic storage containers so that specimens to be analysed will not be contaminated by plasticisers. It should also be noted that acid-free paper, if stored for long periods of time, becomes acidic.

For long-term storage, archaeological textiles are best housed in supportive, stable, non-aging storage mounts with coverings to protect the objects from dust. A good support can be used for storing, studying and exhibiting the object, and will not prevent future scientific analysis. Supports should be of a size that can be moved easily, should allow the object to be examined closely without handling, and ideally would allow it to be positioned under the microscope without the need to remove it. Again, plastic containers of unknown composition should be avoided.

One storage solution is to place the textile fragments on supportive 'beds' in trays or boxes of a stable material such as Correx (corrugated polyethylene sheeting), with lids to allow the stacking of several trays. If the surface of the support is a material with a slight 'tooth', such as Mollino or thin Molton, the object can be held in place without any need for stitching (see Figs 1–3). Non-fibrous materials such as Tyvek ® (polyethylene) cloth used for wrapping or covering textiles will prevent contamination by modern fibres. Archival storage materials can be costly, so it is advisable to budget for them in the excavation plan from the outset.

Conclusion

In compiling these most basic guidelines for the excavation of

textiles, it has not been possible to address all the vastly different conditions that may be encountered by excavators. Some sites may have access to well-equipped laboratories, whilst others may be located in remote areas where the conditions are primitive. Removal of textiles from many sites is prohibited. Textiles may be a chance find of a single, minute fragment, whilst at other sites they form an integral part of the cultural assemblage and may be present in very large quantities. Each situation needs individual assessment, and the procedures should be adapted to suit the prevailing conditions and available resources. However, careful retrieval, minimal interference, adequate documentation and good storage procedures are paramount for the preservation of the textile for future interpretation by specialists.

Fig. 1. Stable support of acid-free cardboard covered with Molton, cut to fit the fragment.

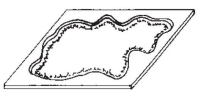


Fig. 2. The support in a 'nest' of acid-free tissue paper/aluminium foil, to enable easy placement and lifting from the box.

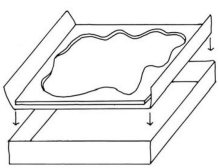
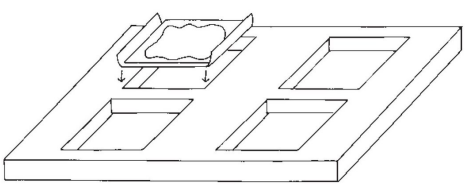


Fig. 3. Each 'nest' can be packed separately, or several fragments can be housed together in one box.

Drawings by Irene Skals



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Glossary of terms

angle of twist

The approximate measurement of the slant of the twist in relation to the vertical axis of the yarn, which determines the tightness of the spun thread.

direction of spin/twist

When a piece of spun yarn is observed in a vertical position, the direction of the twist conforms to the slant of the central part of the letter 'S' (\ ) or 'Z' (/). If there is little or no visible spin, it is termed an 'I' twist.

double-laid yarns

This can occur in the weft (horizontal direction) or in the warp (vertical direction), when two consecutive rows of yarns have not been interlaced correctly, and lie parallel.

matrix

The mass in which a textile or artefact is embedded or enclosed.

plied yarn

A yarn composed of two or more spun yarns twisted together.

selvedge

The longitudinal, 'finished' edge of a textile where the weft turns back on itself.

tabby weave

The most basic weave, in which yarns in the weft are passed over and under alternate warp yarns. Sometimes referred to as 'plain weave'.

thread count

The number of yarns per centimetre in both weft and warp directions in a woven textile.

twill weave

The weft yarns are passed over and under the warp so that each row is stepped to one side of the row above, forming a diagonal pattern of lines.

warp

The yarns which are extended lengthwise in the loom, usually twisted harder than the weft yarns.

weft

The yarns which are interlaced at right angles to the warp, crossing from side to side.

yarn

A group of fibres spun together in preparation for weaving into textile. Contra 'thread', which generally refers to sewing thread.

List of suppliers

General equipment, tools, archival quality storage materials, Tyvek labels, Melinex etc.

CONSERVATION BY DESIGN
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Use of a Digital Camera for Documentation of Textiles

Annemette Bruselius Scharff

A fast and easy method for photo documentation of an archaeological textile, from fiber level to entire object, is described. The equipment used is a Nikon Coolpix 4500, a Macro cool light and an adaptor for the microscope. The images captured at different levels of magnification can be used for measurements like thread count, thread and fiber thickness, and degree and direction of spin. A software program, Scion Image that is shareware from the Internet, are described and demonstrated.

Introduction

A detailed documentation of the physical appearance of a textile, such as actual size, technical analyses of garment and fabric, sewing techniques, description of visual deterioration, plus measurements of thread count, cover factor, yarn thickness, and degree of spinning, can be a very time consuming process, which is limited by the amount of time and money set aside for the operation. These analyses can also result in quite a bit of handling of the textile, which is preferred to be kept at a minimum. It is therefore desirable to do detailed photo-documentation, which quickly gathers and saves information about the textile; further analyses can be done at any time, without necessarily having access to the object. Until recently, the high cost and mixed results of detailed photo-documentation plus the difficulties related to measurements on the photographs, have prevented many people from doing this. However, with the appearance of digital photography, and software

programs for doing digital image analysis, this situation has changed.

The great advantage of digital photography is the ability to immediately see the result. If you are not satisfied with an image, you just delete it and take another one. You can take as many pictures as you want, details as well as the entire textile, and save them for further studies later. The pictures can be saved on many different media, which also makes it easy to distribute the information among colleagues. When you first have invested in a digital camera, it is quick, easy and affordable to get a lot of visual information in a very short time. If you also invest in a microscope adapter for the camera, you can capture images of everything from the entire textile to a single fiber observed in transmitted light.

The Uses of Photo Documentation

When it is so easy and relatively cheap to take digital images of an object, it becomes very simple to increase the number of pictures taken. This makes it possible to do much more detailed photo documentation, for example, during:

1. Conservation, for comparison of visual appearance before, under and after treatment.
2. Research, e.g., when studying large textile collections, the photo documentation can postpone and improve some of the technical analyses.
3. Archaeological excavation, especially when it is difficult to get access to the excavated objects again later.

Furthermore the great advantages of digital photography will probably, make it very popular for all kinds of documentation in the future.

Considerations Before Using Digital Documentation

Before starting digital photo documentation, there are some important aspects to consider, such as the image quality and size, and backing up and archiving of images. In general, to get images with maximum information, they must be captured at highest possible quality and size and saved onto the memory card of the camera as non-compressed files (TIFF or RAW). These files,

however, also take up the most space, and limit the amount of images captured before the memory card is full. In my case a 256 MB memory card could only hold 24 images. A saving of the files as compressed JPEG files will reduce the image quality, but expand the number of images on the memory card. The decision on quality settings depends on the use of the images. If they are meant as temporary work, the quality may not have to be as high as possible, but it is important to consider the pro's and contra's before deciding to lower the quality.

Concerning backing up and archiving, a database should be considered and a backup plan established. The latter should include decisions on how frequent the images must be copied to new storage media, as to avoid future loss of information. Today it has become more common to digitalize collections, and many relevant links on this subject can be found on the Internet. To know more I will suggest looking at two links. The first is written by Sarah Ashworth and Jennifer Fogarty: *A Guide to Digitizing Insect Collections*, which introduce the same camera (Nikon Coolpix 4500) as used in this article: *http://insects.oeb.harvard.edu/MCZ/Guide_to_digitizing.doc*, while the second is the home page of Robert Leopold which contains many links to Digital Imaging Resources: *http://voom.si.edu/*.

Finally I will mention the problem concerning the achievement of correct color exposures. It is possible to color calibrate the images afterwards by using a free software program: *http://www.vips.ecs.soton.ac.uk/index.php?title=VIPS*. However, you must include a color chart in your image, or, as long as the lighting and the camera settings are the same, you can do with one image of the color chart, which can be used for the color calibration of all images taken at the former mentioned settings. The program is set up for a Macbeth Color Checker, but it can be set up for any color chart. To learn more about color calibration, I will suggest going to above homepage and choosing the 'Color Calibration Tour', which will guide you through the procedure.

Camera and Software used

The digital camera I have used for the photo documentation is a 4 megapixel Nikon Coolpix, which has a macro function that allows

you to take pictures of details as small as 14 × 22 mm. Additional equipment, such as an adaptor for the microscope that are inserted into the ocular tube instead of the eyepiece, makes it possible to take microscope photos. The adaptor can be adjusted to most light microscopes, which makes it very easy to document microscope images, see Fig. 1.

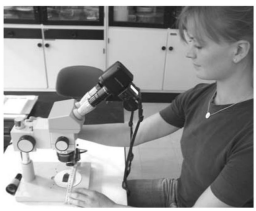


Fig. 1. Photo documentation of a textile observed in a stereomicroscope.

Scion Image was used for the measurements on the digital images. It is an image processing and analysis program that can be used for measuring areas, perimeters, path lengths and angles. The program, which reads and writes TIFF and BMP files only, can be downloaded for free from the Internet: http://www.scioncorp.com.

Documentation and Measurements

To illustrate the great potential of the digital camera, concerning magnification, the following four pictures show the same object taken at different magnifications (Figs. 2–5).

Fig. 2 : Peruvian textile taken with handheld camera. Measuring scale 0.5 cm long.

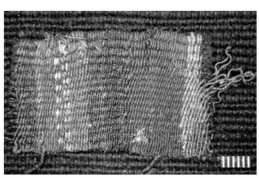


Fig. 3 : Detail taken at maximum magnification. Widths of picture 2.2 cm.

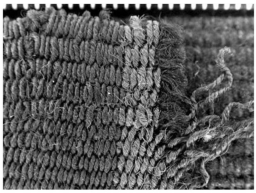
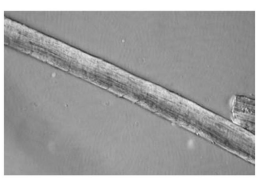


Fig. 4 : Detail taken through the ocular tube of a stereo-microscope.

Fig. 5 : Microscope slide of Alpaca wool fiber. Photographed through the ocular tube of a DIC microscope. The width of the fiber is 13µm.

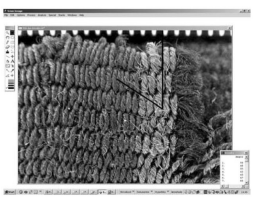


It is thus possible to photo document a textile from object to fiber level, in a rather short time and in such detail that they later can be used for analysis like direction and degree of spinning, thread thickness, thread count and weaving technique. Thus, the handling of textiles will be minimized, and the analyses sometimes even improved, because it can be more precise to measure on a photo, i.e. direction of spinning is difficult to measure directly on the textile, but much easier on the photo.

The photo-documentation of fibers in a transmitted light microscope can be of great help for the identification of fibres. Comparison of details like scale patterns are much easier when comparing photographs, rather than observing details in the microscope. Measurements of fibre dimensions are also simple when having a photo of the fibre and the stage micrometer at the exact same magnification.

The measurements are done by opening the image files (TIFF or BMP) in Scion Image. Fig. 6 shows the measurement of degree of spinning, by measuring the angle. This measurement does not require a measuring scale in the image, something that is necessary when correct distances or areas need to be measured. The program is fairly simple to use, having a toolbar for selecting the kind of measurement you need for analysis (areas, angles or distance), and it comes with an instruction manual.

Fig. 6: Detail of textile opened by Scion Image. The picture illustrates measuring angles for documentation of degree of spinning. Six measurements have been done on the image, showing a variation of degree of s pinning from 44 to 52 degrees.



Conclusion

By using a digital camera for photo-documentation of textiles, it becomes very simple and affordable to increase the amount of pictures taken of details and the entire textile. These pictures can be used for postponing and improving certain technical analyses, which result in a minimum handling of the textile and at the same time, gives you more flexibility concerning when and where these analyses are done. However, the long time storage of the image files is problematic, and something that needs to be considered carefully, before digital documentation is started. Therefore, if you want your images to be available for the future generations, the best thing to do is to consult an expert who can help you to select file formats and procedures for backing up and archiving the images.

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General Bibliography

Abbreviations

The abbreviations used are the ones found in the American Journal of Archaeology and are in common use. See http://www.ajaonline.org/shared/s_info_contrib_7.html. In addition, the following have been employed:

Archéologie des textiles	*Archéologie des textiles, des origines au Ve siècle. Actes colloque de Lattes, oct 1999, des textiles* (eds.) D. Cardon & M. Feugère, Monographies Instrumentum 14.
ATN	*Archaeological Textiles Newsletter.*
C.I.E.T.A.	Centre Internationale d'Études Textiles Anciens.
CIL	*Corpus Inscriptionum Latinarum.*
DFIFAO	Documents de fouilles de l'Institut français.
ICOM	International Council of Museums.
LIMC	*Lexicon Iconographicum Mythologiae Classicae,* Zürich, Düsseldorf.
Mammen	*Mammen: Grav, kunst og samfund i Vikingetid*, Jysk Arkæologisk Selskabs Skrifter XXVIII.
Minoan Villa	*The Function of the "Minoan Villa". Proceedings of the Eighth International Symposium at the*

	Swedish Institute at Athens, 6–11 June 1992, (ed.) R. Hägg, ActaAth 4:46.
NESAT	North European Symposium on Archaeological Textiles.
NESAT 6	*Textiles in European Archaeology: Report from the 6th NESAT Symposium, 7–11 May 1996 in Borås*. GOTARC (eds.) L. Bender Jørgensen & C. Rinaldo, Series A, Vol. 1.
SAA	*South Asian Archaeology*.
TAW III	*Thera and the Aegean World III. Proceedings of the Third International Congress. Santorini, Greece 1989*, (eds.) D. A. Hardy et al.
TEXNH	*TEXNH Craftsmen, Craftswomen and Craftsmanship in the Aegean Bronze Age. Proceedings of the 6th International Aegean Conference, Philadelphia, April 1996*, (eds.) R. Laffineur & P. Betancourt, Aegaeum 16.
The Roman Textile Industry	*The Roman textile industry and its influence. A birthday present to John Peter Wild*, (eds.) P. Walton Rogers, L. Bender Jørgensen & A. RastEicher.

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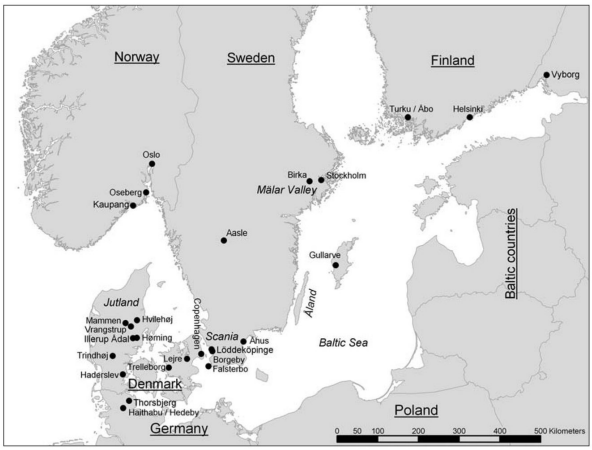
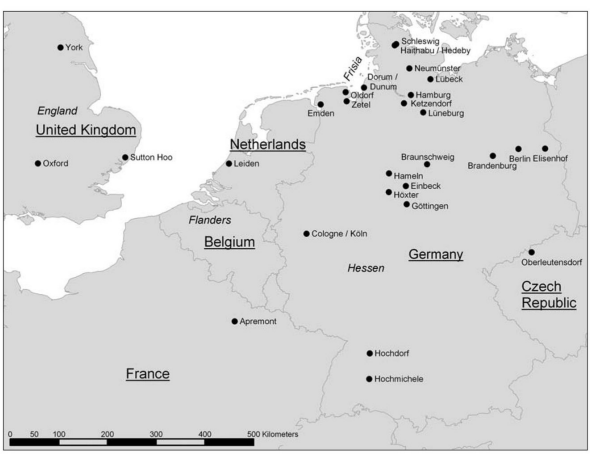
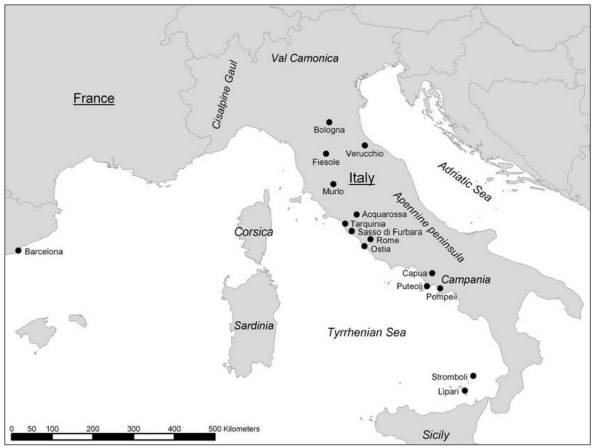


Map 1: Central and southern Scandinavia.

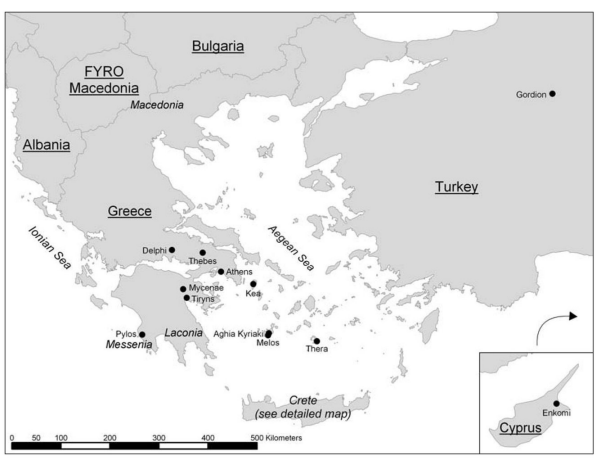


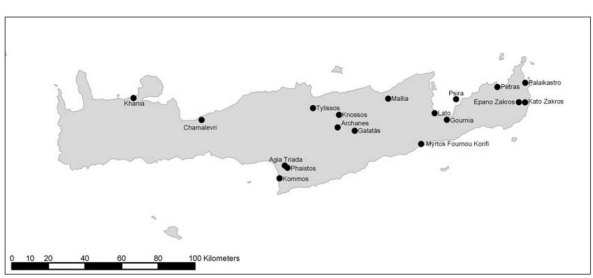
Map 2: Germany, Benelux and surrounding areas.

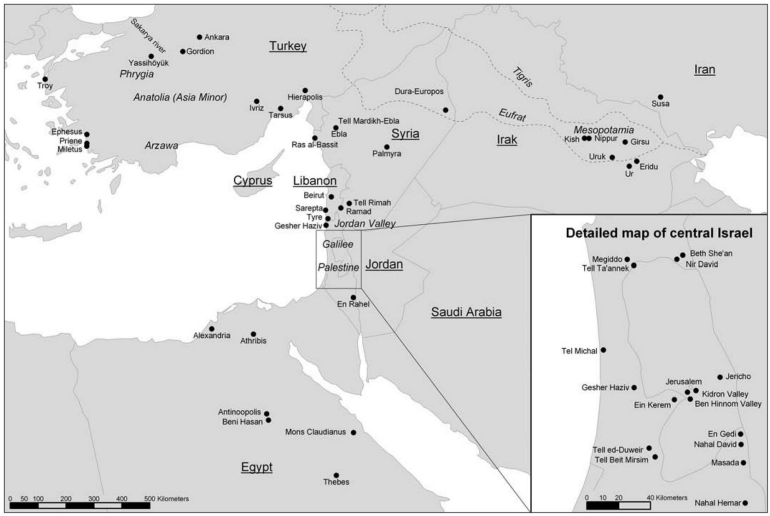
Map 3: Italy.



Map 4: Greece and surrounding areas.





Map 5: Crete.

Map 6: The Eastern Mediterranean.